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Work Plan Addendum Targeted Brownfield

Lake Conestee SC

Work Plan Addendum

Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee – Greenville, South Carolina

Prepared for:
US Army Corps of Engineers-Charleston District
Charleston, SC

September, 2002

Zapata Engineering, Inc. Charlotte, North Carolina
Pinnacle Consulting Group, Inc. Greenville, South Carolina

Rec'd 9/10/02

- Alan Shirey; [illegible] ... msg for Michelle Cook on 9/12/02.
  - Were replacement pages re[illegible]
  - comments due on 9/13/0[illegible]
- jms contacted Alan + introduced herself as new mgr.

.E PINNACLE CONSULTING GROUP

September 5, 2002

Mr. Dennis McKinley, Project Manager
US Army Corps of Engineers, Charleston District
69 Hagood Avenue
Charleston, South Carolina 29403-5107

Subject: Revised Work Plan-Targeted Brownfields Assessment – Follow-up Investigation
Lake Conestee Site – Greenville County, South Carolina

Dear Mr. McKinley:

Please find attached five (5) copies of revised pages for the above-referenced document. These replacement pages should be substituted and inserted into current report binders as described below:

General

1. Remove and discard the Draft cover and spine from the outside of the binder and insert the attached, replacement color cover and spine.
2. Remove and discard the Work Plan title page and the Certification page and replace with the attached, revised title page and certification page. These are the two pages immediately preceding the "Work Plan Addendum" tab.

Work Plan Addendum

3. Remove and discard the entire text section of the Work Plan Addendum from page i (Table of Contents) through page 17 of 17, inclusive. Replace the entire text section with the attached, revised text.
4. Remove and discard Figure 6, and replace with the attached, revised Figure 6.
5. Remove and discard Figure 9, and replace with the attached, revised Figures 9A, 9B, and 9C.
6. Remove and discard Figure 10, and replace with the attached, revised Figure 10.
7. Remove and discard Figure 11, and replace with the attached, revised Figure 11.

FSAP

8. Remove and discard the entire text section of the FSAP, and replace with the attached, revised FSAP.

QAPP

9. Remove and discard the entire text section of the QAPP, including Table 1, Table 2, Figure 1, and Figure 2, and replace with the attached, revised QAPP with tables and figures.
10. Remove the Attachment 1 Title Page, and replace with the attached, revised Attachment 1 Title Page.
11. Insert the Accutest Labs SCDHEC certification pages immediately after the Attachment 1 Title Page.

As I discussed with Alan Shirey yesterday, the Site Safety and Health Plan (Appendix C) is forthcoming and will be shipped to you no later than September 9, 2002.

Please feel free to contact me at (864) 467-0811 or Greg Hippert of Zapata Engineering (704) 358-8240 with any questions or comments.

Respectfully submitted,

The Pinnacle Consulting Group, Inc.

Jerry A. Wylie, PG (SC-891)
Project Manager

Attachment

Distribution: Mr. Greg Hippert – Project Manager, Zapata Engineering (2 copies)
Dr. David Hargett – Project Coordinator, Pinnacle (1 copy)
Mr. Dana Leavitt – President, The Conestee Foundation (1 copy)

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Work Plan Addendum

Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee– Greenville, South Carolina
(DACW60-00-D-0002)

Prepared for:

US Army Corps of Engineers-Charleston District
Charleston, SC

Prepared by:

Zapata Engineering, Inc. – Charlotte, North Carolina
Pinnacle Consulting Group, Inc. – Greenville, South Carolina

Submitted

September 5, 2002

The information contained herein has been reviewed and interpreted as being complete to the best of my knowledge. I further attest, to the best of my knowledge, that the information has been prepared in accordance with industry standards and with the applicable regulations.

Jerry A. Wylie
South Carolina Professional Geologist #891

SEP 05 2002
Date

JERRY A. WYLIE
REGISTERED
No.
891
SOUTH CAROLINA
PROFESSIONAL GEOLOGIST

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List of Acronyms

ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	contaminants-of-concern
DQO	data quality objectives
FSAP	Field Sampling and Analysis Plan
GPS	Global Positioning System
IDW	investigation derived waste
msl	mean sea level
NCP	National Contingency Plan
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SCDHEC	South Carolina Department of Health and Environmental Control
SSHP	Site Safety and Health Plan
SVOC	semi-volatile organic compounds
TAL	Target Analyte List
TBA	Targeted Brownfields Assessment
TCL	Target Compound List
USACE	United States Army Corps of Engineers
US EPA	United Stated Environmental Protection Agency
VOC	volatile organic compound
WCRSA	Western Carolina Regional Sewer Authority

DRAFT WORK PLAN DOCUMENT DEVELOPMENT NOTES

Much of the information, procedures, and methods developed for the initial phase Targeted Brownfields Assessment are relevant to and will be used in the implementation of the follow-up investigation. As such, this Addendum has been developed to include the original Work Plan and most of its elements. New information, procedures, and methods have been added to the original Work Plan, as appropriate, to reflect the scope of work for the follow-up investigation. Text/information that pertained exclusively to the original initial investigation (e.g., assessment locations) have been deleted.

1.0 INTRODUCTION

The purpose of this Work Plan Addendum is to provide procedures for performing a follow-up investigation to the initial phase of assessment associated with the Targeted Brownfields Assessment (TBA) of the Lake Conestee property located in Greenville County, South Carolina. The initial phase of the TBA was conducted in November/December 2000. The results of the initial phase of the TBA were reported to the South Carolina Department of Health and Environmental Control (SCDHEC) in March 2001 (Pinnacle, March 8, 2001). Included in this Work Plan Addendum are updates to the Field Sampling and Analysis Plan (FSAP), Site Safety and Health Plan (SSHP), and Quality Assurance Project Plan (QAPP).

Purpose

The overall objectives of the follow-up investigation are to (1) assess releases of hazardous substances onto the property that could impact the use of the property as a community greenspace, passive recreation area, and environmental education resource. The results of this investigation will also be used in (2) determining the need for remediation or release control measures to protect human health and the environment. Specific project objectives include:

- Determine sediment and surface water contaminant levels in areas of Lake Conestee not previously sampled;
- Determine fish tissue contaminant levels in specific areas of Lake Conestee for the purpose of supporting human health exposure assessments;
- Determine background soil and background/upstream sediment concentrations for the purpose of estimating regional sediment metals concentrations; and
- Determine contaminant levels in surface waters and sediments that have become accessible to human exposure with the lake at full pool.

The assessment activities conducted in association with the investigation will be consistent with the intent of the National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300.68 (a – j). In addition, the Work Plan Addendum has been developed in general accordance with the guidelines presented in Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (US EPA, 1988).

A detailed description of the assessment activities is included in the Addendum to the FSAP (Appendix A). Procedures utilized to maintain data precision, accuracy, and completeness and to ensure comparisons in environmental metrics/measurements are described in the Addendum to the QAPP (Appendix B). An Addendum to the SSHP, designed to protect site workers, is included as Appendix C.

2.0 SITE HISTORY AND SETTING

(Note: This entire section is reproduced from the Work Plan – Targeted Brownfields Assessment – Initial Phase (Pinnacle, November 10, 2000)).

Lake Conestee is located in south-central Greenville County, South Carolina in the unincorporated town of Conestee, South Carolina (Figures 1, 2, and 3) approximately seven miles south of the city of Greenville, South Carolina. The site coordinates (using the Lake Conestee dam as the reference location) are 34° 46' 12" north latitude and 82° 20' 56" west longitude. The 144.97-acre site was purchased from Mr. H.J. Brand (Conestee, South Carolina) by a non-profit organization, The Conestee Foundation in 2001. The site is currently zoned I-1 (Light Industrial). The Reedy River bisects the property, and the lake is estimated to be volumetrically over 95% silted-in.

2.1 SITE HISTORY

Lake Conestee was created for use as a mill pond around 1830 when a dam was constructed across the Reedy River. The dam was constructed to provide mechanical power to a mill that produced paper products. In later years, the mill produced cotton textile goods. In the late 1800's, the power plant was converted to generate hydroelectric power for Conestee Mills and the mill community. In 1892, a wastewater treatment plant was constructed by the City of Greenville at an upstream location (about two miles) on the Reedy River. Concentrated discharges to the Reedy River from this treatment plant accelerated degradation of Lake Conestee. In the mid-1920's, Conestee Mills sued the City of Greenville alleging that the discharges from the treatment plant had contaminated Lake Conestee to such a degree that the water was no longer usable by the mill. Conestee Mills won the case and a later appeal was also upheld. The original dam is believed to have been replaced in the 1880's by the current structure. At this writing, the US Army Corps of Engineers – Charleston District (USACE) is conducting design studies for certain maintenance and improvement features to the dam. This work is being performed through Section 206 of the Water Resources Development Act of 1996.

Throughout its history, Lake Conestee has been impacted from both point and non-point sources from within the 65 square mile watershed above the lake. This area includes nearly all of the City of Greenville and many of the City's older industrial areas. In addition to the deposition of impacted sediments within the lake area, there have been releases of sediments downstream of the dam. The condition of downstream sediments was assessed, to a limited extent, in the Phase I TBA (Pinnacle, March 8, 2001).

Observation of two aerial photographs, one taken in 1943 (Figure 4) and one in 1999 (Figure 5), reveals the significant changes that have occurred to Lake Conestee in the last 50-plus years. The sediment load from the Reedy River and Marrow Bone Creek (tributary to west side of the lake) has deposited large quantities of sediment sufficient to essentially fill the lake with sediment. Later, after the western part of the lake had become silted in from the sediment deposited by the Reedy River and Marrow Bone Creek, a new deltaic feature developed at the northern end of the eastern lobe of the lake. Reedy River deposition again resulted in the infilling of this area and the river meandered, cutting a new channel between the eastern and southern lobes of the lake.

The dam gate has been uncontrolled since the 1950's, and it has become progressively more dilapidated in recent years, such that the gate has often remained substantially log-jammed for years at a time. Because of this condition, it is likely that sediments have periodically been released in varying amounts to the Reedy River below the lake. In May or June 2000, the gate area, which had been plugged with debris, unclogged and released sediments downstream. As a result of the reconnection of the river to its original local base level, through the open gate orifice, the river began a rapid down-cutting action in the sediments behind the dam. Simultaneously, with the effect of dewatering the lake, the southern and eastern lobes of the lake dried up. The Reedy River eroded a "canyon" through the previously deposited lake sediments resulting in transport of lake sediments downstream through the open dam gate. The degree of incision was approximately 10 feet near the dam. Based on studies conducted by staff at the Natural Resources Conservation Service – US Department of Agriculture and sponsored by the Foothills Resource Conservation & Development Council in October 2000 and May 2001, the volume of sediments lost from the "canyon" was estimated to be approximately 90,000 cubic yards. In June 2001, these agencies installed an emergency "plug" (a timber cover) behind the orifice through the Emergency Watershed Protection Program. This temporary repair effectively stopped the catastrophic loss of sediment from the lake.

2.2 GEOLOGIC SETTING

The site is situated in the Piedmont physiographic province of South Carolina. The Piedmont province is broad and plateau-like with ground elevations that range from about 400 to 1,200 feet above mean sea level (msl). The Piedmont is cut by streams that develop a dendritic drainage pattern. Generally, major stream flow is to the southeast. The Lake Conestee site lies in the Inner Piedmont belt of the Piedmont geologic province. The Inner Piedmont belt is a northeast trending belt of igneous and metamorphic (crystalline) rocks that are collectively referred to as bedrock. The predominant rock types in the regional area are highly metamorphosed gneiss and schist intruded by igneous rock. Koch (1968) mapped Greenville County and showed the Lake Conestee area lying within a granitic gneiss complex close to the contact with a mica schist complex. Conversely, Overstreet and Bell (1965) showed the Lake Conestee area to be underlain by granite.

Typically in the Piedmont, a variable thickness of regolith extends from the ground surface and overlies the bedrock. Regolith is characterized by a mixture of unconsolidated material, including saprolite (in-place weathering byproduct of bedrock), alluvium (surface water deposits), colluvium (slope wash and other mass wasting deposits), and soil. Typically, the regolith contains both zones of saturated and unsaturated conditions; although, unconfined conditions predominate in the regolith/alluvium. Groundwater is recharged as a direct effect of precipitation and infiltration in topographically higher areas. Discharge areas are generally near streams in valley bottoms. Groundwater in the regolith is stored and transmitted through openings (pores) between soil and rock particles. Groundwater in the regolith zone supplies and recharges groundwater in the fractured bedrock. However, the residual soil and saprolite have a low permeability; therefore, they readily store considerable quantities of groundwater but release this water slowly to fractures within the underlying bedrock. In addition, a local flow system exists within the regolith often providing preferential flow paths in coarser lenses and in the remnants of geologic structural features in the weathered rock. Groundwater in the bedrock is generally restricted to the upper bedrock zone (< 200 feet below ground surface) because fractures tend to decrease in frequency and the degree of openness at depth.

3.0 PREVIOUS INVESTIGATIONS

Initial/Preliminary assessment activities, associated with the TBA of the 145-acre Lake Conestee site in Greenville County, South Carolina were completed in November/December_2000. The assessment activities included the collection and analysis of environmental samples from the Reedy River sediments downstream of the Lake Conestee dam (10 locations); sediments from Lake Conestee impounded areas, including isolated pools, sloughs, and beaver-impounded wetlands (29 locations); surface water samples from Lake Conestee, including isolated pools, sloughs, and beaver-impounded wetlands (13 locations); and surficial and subsurface sediments from two former deltaic areas in Lake Conestee (six locations). The sampled media were analyzed by the United States Environmental Protection Agency (US EPA) Contract Laboratory Program (CLP) contract laboratories for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), total metals, including hexavalent chromium, and cyanide.

Detected concentrations were compared to appropriate regulatory action levels. Detectable concentrations of residual VOCs, SVOCs, pesticides, PCBs, and metals were found in Reedy River sediments downstream of Lake Conestee, Lake Conestee sediments, and sediments from former Lake Conestee deltaic areas. Detectable concentrations of residual VOCs, SVOCs, and metals were found in Lake Conestee surface water samples. Regulatory screening levels were exceeded for many of the detected residual chemicals. Complete discussion and presentation of assessment activities and results, including a description of the limited 1978 SCDHEC sampling event, are presented in the Initial Targeted Brownfields Assessment Report-Lake Conestee Site Greenville County, SC (Pinnacle, March 8, 2001).

4.0 TECHNICAL APPROACH AND DATA QUALITY OBJECTIVES

As previously described, the objectives of the TBA follow-up investigation are to assess releases of hazardous substances onto the Lake Conestee property in areas that have not been previously sampled. This information will be used to assess the use of the property as a community greenspace and to assist in determining the need for remediation or release control measures to protect human health and the environment.

Assessment activities include data gathering and analysis to evaluate the nature and general extent of residual contaminants-of-concern (COCs). The data must be of sufficient quality and quantity to support subsequent site-related activities (e.g., risk assessment/evaluation, feasibility studies, etc.).

Data quality objectives (DQOs) are established to focus the data acquisition effort to meet the objectives of the investigation. Guidance for the Data Quality Objectives Process (US EPA, 2000) provides seven steps in the DQO process:

1. State the Problem
2. Identify the Decision
3. Identify Inputs to the Decision
4. Define the Boundaries of the Study
5. Develop a Decision Rule
6. Specify Tolerable Limits on Decision Errors
7. Optimize the Design

For Lake Conestee, DQOs will be based on available site knowledge and initial assessment information. DQOs will be revised as data is collected and elements are no longer relevant. DQOs will be evaluated with respect to data quality control, implications relative to the determination of the nature and extent of impact, implications relative to potential remedial alternatives, and implications relative to public health and ecology.

The following sections provide a discussion of the types and end-uses of the various data that is anticipated to be generated during the follow-up assessment activities. The anticipated sample locations (as described in the Addendum to the FSAP) and the decisions made from the resultant data are spatial in nature (i.e., data used to define the concentration of COCs in sediment). No time-dependent data variations are anticipated.

4.1 DATA NEEDS – BACKGROUND SOIL AND SEDIMENT SAMPLES

The decision developed from analysis of background soil and sediment data is to determine the concentrations of naturally-occurring metals in the regional/local soils and sediments. The nature of metals concentrations will be evaluated by analyzing samples of sediments along the Reedy River several miles upstream of Lake Conestee and soils from Taylor's Island for Target Analyte List (TAL) metals. Based on the data generated, residual chemical impacts to Lake Conestee soil and sediment will be compared to these background concentrations to assist in identifying areas of Lake Conestee that contain elevated levels of COCs in soil and sediment. This comparison data will be used (1) to develop a more detailed assessment plan, (2) in analyzing the potential for threats to human health and the environment, and/or (3) in remediation planning.

4.2 DATA NEEDS – FISH TISSUE SAMPLING

The decision developed from analysis of fish tissue is to determine the concentrations of site COCs in fish from Lake Conestee. The nature of COCs in fish tissue will be evaluated by analyzing samples for PCBs, organo-chlorine pesticides, and TAL metals. Based on the data generated, contaminant concentrations in the fish tissue will be compared to applicable standards and comparison criteria to determine whether there is a threat to human health (via ingestion of fish) and the environment. Based on this data, a determination can be made for the need for development of either a more robust assessment strategy and/or remedial action planning.

4.3 DATA NEEDS – SEDIMENT/SURFACE WATER FROM UNSAMPLED AREAS

The decision developed from analysis of sediment and surface water collected from previously unsampled locations is whether detected COCs constitute a threat to human health or the environment in two specific areas of Lake Conestee that have not been assessed (Marrow Bone Creek delta area (West Bay) and upstream lake areas). The nature of COCs in sediments and surface water will be evaluated by analyzing samples for TAL metals, VOCs, SVOCs, polyaromatic hydrocarbons (PAHs), PCBs, and organo-chlorine pesticides. Based on the data generated, residual chemical impacts to sediments and surface waters in these previously uninvestigated areas will be compared to standards derived from risk-based concentrations or chemical-specific applicable or relevant and appropriate requirements (ARARs) to determine whether there is a threat to human health and the environment. Based on this data, a determination can be made for the need for development of either a more robust assessment strategy and/or remedial action planning.

4.4 DATA NEEDS – SEDIMENT/SURFACE WATER FROM NEW EXPOSURE AREAS

The decision developed from analysis of sediment and surface water collected from newly-exposed areas is whether detected COCs constitute a threat to human health or the environment throughout the Lake Conestee now that lake is at "full pool." These "new" exposure areas are those in the near-shore environment where humans are most likely to have exposure to the sediments and surface water through fishing, wading, or other recreational activities. The nature of COCs in sediments and surface water at these locations of changed conditions will be evaluated by analyzing samples for TAL metals, PAHs, PCBs, and organo-chlorine pesticides. Based on the data generated, residual chemical impacts to sediments and surface waters in these areas of changed conditions will be compared to standards derived from risk-based concentrations or chemical-specific ARARs to determine whether there is a threat to human health and the environment._Based on this data, a determination can be made for the need for development of either a more robust assessment strategy and/or remedial action planning.

4.5 DATA NEEDS – SURVEYING

Many of the decisions to be made using data derived from the follow-up investigation activities are spatial in nature. Therefore, accurate and reproducible sample location information is important. Knowledge of the horizontal location of data points, and in some cases vertical information, is needed. Data point location information will be collected using Global Positioning System (GPS) equipment with an accuracy of +/- 10 feet.

4.6 CHEMICAL ANALYSES

Results of chemical analyses will be compared to standards derived from risk-based concentrations or chemical-specific ARARs to determine whether there is a threat to human health and the environment. The following considerations will be used relative to chemical analyses:

- Analytical procedures consistent with DQO Level III, as described in US EPA's Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846 (US EPA, 1992), will be utilized.
- Samples will be analyzed for parameters as described above and in the FSAP.
- Specific quality assurance/quality control (QA/QC) requirements are defined in the QAPP.

5.0 FOLLOW-UP INVESTIGATION TASKS

The work activities to be performed during the follow-up investigation are outlined in this section. Field sample collection techniques and procedures are included in the Addendum to the FSAP. Analytical information and information concerning the QA/QC process is included in the Addendum to the QAPP.

5.1 FIELD INVESTIGATION

The methods employed in the follow-up investigation have been designed to meet the established DQOs. This section generally describes the methods for continuing the investigation of the nature and extent of residual chemical impact to the soils, sediments, and surface waters of Lake Conestee. Investigation procedures are presented in Appendix B – Addendum to the FSAP. Based on the data derived from this follow-up investigation, a more detailed assessment strategy will be developed or remedial action planning will be initiated.

5.1.1 Background Soil and Sediment Sampling

Surficial soil samples and shallow sediments will be collected as a means of quantifying naturally-occurring concentrations of metals from sediments and surficial soils within the watershed. Three surficial soil samples, collected from 6 to 12 inches in depth, will be taken from Taylor's Island from areas of the former island above historic inundation elevation. Three sediment samples will be collected from natural sediment accumulation environments miles upstream of Lake Conestee. Three composite sediment samples will be collected from three distinct locations. At each location, three separate sediment aliquots will be homogenized into a single, composite sediment sample that will be submitted for analysis representing that specific sample location. All three samples will be collected from the Reedy River or its tributaries upstream of the influence of the City of Greenville. Collected samples will be analyzed for TAL metals. The general locations for collection of the background sediment samples are indicated on Figure 6. Specific sample locations, conforming to the characteristics of the desired depositional setting, will be selected in the field.

5.1.2 Fish Tissue Sampling

Ten fish will be collected from various habitats in Lake Conestee (Figure 7). Fish will be collected from the various locations around the Lake Conestee site where fishing activities are common and have been observed. The fish will be collected using a backpack electroshocking device by a licensed fisheries biologist qualified to perform these tasks. Observations will be made and recorded relative to the number of individuals observed, the species of fish observed, the relative sizes of the individuals, and any abnormalities associated with individuals. Sampling preference will be given to (1) species type: catfish preferred over bass preferred over pan fish, and (2) size of individual with a sampling preference for the largest individual. The fish tissue samples (fillets) will be analyzed for PCBs, organo-chlorine pesticides, and TAL metals to determine the presence, absence, and degree of contaminant concentrations in Lake Conestee fish. The number of fish to be collected from each habitat is based on a distribution of the 10 allotted samples relative to the size of the habitat: T3

- 3 fish will be sampled from the east bay;
- 2 fish will be sampled from the south bay;
- 3 fish will be sampled from representative locations along the Reedy River channel as it courses through Lake Conestee; and
- 2 fish will be sampled from the beaver-impounded waters of the west bay and Marrow Bone Creek.

5.1.3 Sediment/Surface Water Samples from Unsampled Areas

Sediment and surface water samples will be collected from two areas that were not sampled during the initial TBA assessment: (1) the west bay/Marrow Bone Creek delta area and (2) upstream areas of the lake (Figure 8). The assessment locations may be accessed by both/either boat and by foot. The sediment samples (surface to 24 inches with any vegetation and recently deposited material discarded) will be collected using a sediment coring device (discussed in the Addendum to the FSAP), and the surface water samples will be collected directly into the sampling containers (unpreserved bottleware) or decanted from a precleaned, location-dedicated container into the bottleware containing preservative.

West Bay Area: Fifteen shallow sediment samples and five surface water samples will be collected from this area. A sediment sample will be collected at each of the five surface water sample locations. Both the sediment samples and the surface water samples will be analyzed for TAL metals, PCBs, organo-chlorine pesticides, and PAHs. VOC and SVOC analysis will be conducted on 20% (3 sediment and 1 surface water) of the samples.

Upstream Lake Areas: Ten shallow sediment samples and five surface water samples will be collected from this area. A sediment sample will be collected at each of the five surface water sample locations. Both the sediment samples and the surface water samples will be analyzed for TAL metals, PCBs, organo-chlorine pesticides, and PAHs. VOC and SVOC analysis will be conducted on 20% (2 sediment and 1 surface water) of the samples.

Due to the inherent difficulty in accessing the areas and the continually changing landscape of the target areas, the exact sample collection locations will be selected in the field based on the following priorities: (1) collecting samples from representative environs (e.g., beaver impounded areas, Marrow Bone Creek, former creek discharge/delta areas, cut-off meanders/sloughs, areas of high-water inundation, etc.) and (2) collecting samples at specific locations to ensure adequate spatial coverage across the West Bay/Marrow Bone Creek area and the Upstream Lake area.

5.1.4 Sediment/Surface Water from New Exposure Areas

Sediment and surface water samples will be collected from selected areas around the Lake Conestee site that reflect the change of site conditions caused by the repair of the dam and the return of "full pool" conditions. The assessment locations may be more safely accessed by boat or foot depending on site-specific constraints. The sediment samples (surface to 24 inches with any vegetation discarded) will be collected using a sediment coring device (discussed in the Addendum to the FSAP) for submerged samples or a stainless steel hand auger for exposed sediments. The surface water samples will be collected directly into the sampling containers (unpreserved bottleware) or decanted from a precleaned, location-dedicated container into the bottleware containing preservative.

Twenty-five shallow sediment samples and 10 surface water samples will be collected from these areas. A sediment sample will be collected at or near the majority of the 10 surface water sample locations. Both the sediment samples and the surface water samples will be analyzed for TAL metals, PCBs, organo-chlorine pesticides, and PAHs. The proposed locations for the samples are provided in Figures 9A – 9C.

- One exposed sediment sample and one surface water sample will be collected from the crescent-shaped slough located in the south-central portion of the site.
- Two exposed sediment samples, one submerged sediment sample, and two surface water samples will be collected from the South Bay area.

- Five exposed sediment samples and three submerged sediment samples will be collected from the East Bay area. Six surface water samples will be collected from the East Bay area to complement the data generated from sediment and fish tissue sampling.

- Eleven exposed sediment samples and two submerged sediment samples will be collected from the Taylor's Island/West Delta area. Two surface water samples will be collected.

5.1.5 Investigation-Derived Waste (IDW)

Soil and sediment "cuttings"/excess resulting from the collection of samples will be discarded on-site near their source. Liquid IDW from decontamination of equipment will be collected and temporarily stored on-site (temporary storage not to exceed 45 days from completion of field work). Disposal options for the liquid IDW will be determined by analyzing a sample of the liquid for TAL metals, PCBs, organo-chlorine pesticides, VOCs, and SVOCs.

5.1.6 Sample Management

Records of sample collection and shipment, analytical results, QA/QC reviews, and any other documentation will be maintained in such a way that only final and approved analytical data are used in the analysis of site conditions. DQOs for any task that involves chemical analysis will be used as the basis for determining whether the information/data is valid, valid with qualifiers, or invalid.

5.1.7 Sample Analysis Validation

Data collected during the follow-up investigation will be in accordance with the methods and protocols established in the QAPP (Section 5.0). The samples will be analyzed by SW-846 (Level III) methodologies.

5.1.8 Data Validation

Data validation procedures are discussed in the QAPP (Section 5.0).

5.2 DATA EVALUATION AND REPORTING

Evaluation of the data collected during the follow-up investigation will focus on evaluating the nature and general extent of residual COCs. The data will be used, if necessary, to design subsequent site-related activities (e.g., additional assessment, risk assessment/evaluation, feasibility studies, etc.). The data will be evaluated and a final report will be prepared and submitted that includes:

- Description of the physical characteristics and environmental setting of the site;
- Site plans indicating the type and location of sampling points;
- Nature and extent of contamination (presence/absence, concentration, and extent of COCs in natural media); and
- Limited evaluation of contaminant fate and transport of detected contaminants to support the site conceptual model and human health/environmental evaluation.

In addition, the final report will include a limited evaluation of the potential for human health and environmental impacts at the site. This evaluation will include analysis and discussion of COCs, exposure assessment, toxicity assessment, uncertainty analysis, and a comparison of detected COC concentrations to US EPA and SCDHEC risk assessment levels. The final report will include details of the completed field activities; any deviations from the approved work plan procedures, maps, tabulated data, field logs, and raw data.

Draft and Final versions of the report (five copies of each version) will be submitted to the USACE for review and approval. The Draft and Final versions of the report shall be furnished with a professional certification signed by a registered geologist or engineer, as required by the State of South Carolina.

5.3 QUALITY ASSURANCE

The Addendum to the FSAP (Appendix A) for the follow-up investigation effort at Lake Conestee specifies the standard techniques and procedures that will be used for sampling and analysis. The Addendum to the QAPP (Appendix B) provides the procedures that will be utilized to assure that the data collected during the follow-up investigation at Lake Conestee are consistent with the specific quality goals of accuracy, precision, completeness, and representativeness. The FSAP and the QAPP have been prepared in accordance with US EPA Region IV Environmental Investigations – Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001) and EPA Guidance for Preparing Quality Assurance Project Plans (US EPA, 1998).

6.0 PROJECT MANAGEMENT

6.1 PROJECT TEAM

This project is being conducted under Delivery Order DACW60-00-D-0002. An organizational chart with the project team is included as Figure 10. The A-E's project manager shall oversee the coordination and execution of the entire project.

Greg Hippert will serve as the Zapata Engineering (A-E) and overall project coordinator. In this role, he will coordinate the work elements that the A-E will implement, assist as needed in and supervise the field efforts, assist with data review and evaluation, and will prepare relevant sections of the final report. Mr. Hippert will provide support for the Site Health and Safety Officer. He will be responsible for overall administrative program management, communication with the USACE, and resource allocation for Zapata.

Jerry A. Wylie, P.G. will serve as the Pinnacle Consulting Group project manager and certifying South Carolina Professional Geologist of record for the project. In this role, he will coordinate the work elements that Pinnacle will implement, assist Zapata Engineering with the work elements for which Zapata will have primary responsibility, assist in the field efforts, assist with data review and evaluation, and will coordinate submittals to the appropriate parties. Mr. Wylie will both participate in and supervise the data gathering efforts and will be on site for a representative portion of the field activities. He will be the primary writer of the final report. Mr. Wylie will be responsible for overall administrative project management and resource allocation for Pinnacle.

Bradley Kuntz will serve as the A-E's sampling and field operations manager. Mr. Kuntz will be responsible for the planning and implementation of the field effort.

David L. Hargett, Ph. D., CGWP, CPSS will serve as a Senior Consultant and liaison with the site owner, The Conestee Foundation. In these roles, he will be a primary communication contact for all parties. In addition, he will be involved in technical aspects of the effort to ensure that the overall goals of the effort are attained. Dr. Hargett has spent hundreds of hours on Lake Conestee and has unequaled knowledge of the site. Dr. Hargett will be a primary QA/QC reviewer.

Andy Schneider will serve as the Site Health and Safety Officer (HSO). His primary role will be to ensure the compliance of all site workers/visitors with the SSHP.

Sherman Woodson, CIH, will serve as the Certified Industrial Hygienist for the project. He will prepare the SSHP and will ensure its conformance to USACE requirements. He will support the Site HSO in ensuring conformance with the SSHP.

Todd Scott will serve as the Database Manager. He will review all analytical data for accuracy and completeness and conduct a data validation assessment. In addition, he will provide support relative to statistical analysis of data.

6.2 PROJECT COMMUNICATIONS

Zapata Engineering and Pinnacle Consulting Group will attend a work review meeting in Greenville, South Carolina after review of the draft work plan, and a public availability meeting in Greenville, South Carolina after the final report. The USACE, assisted by SCDHEC, the US EPA, and the Conestee Foundation, will be responsible for communicating with the members of the community. The Zapata/Pinnacle team will assist with communicating the technical aspects of the project and will relay information between interested parties.

6.3 DOCUMENT CONTROL

All documents (e.g., reports, correspondence, approvals etc.) prepared by Zapata/Pinnacle will be submitted to:

Mr. Dennis McKinley
US Army Corps of Engineers, Charleston District
69 Hagood Ave.
Charleston, South Carolina 29403-5107

Mr. Dana H. Leavitt, President
The Conestee Foundation
1 Marshall Court
Greenville, South Carolina 29605

The distribution list for technical documents relating to the project include, in addition to those listed above:

- SCDHEC (Attention: Angela Gorman)
- US EPA Region IV (Attention: Michelle Cook)

6.4 PROJECT SCHEDULE

The schedule for implementation of the follow-up investigation is included as Figure 11. The schedule is a timeline of activities and milestone events associated with implementation of the assessment work.

7.0 REFERENCES

Koch, N.C., 1968. Ground Water Resources of Greenville County, South Carolina: South Carolina Geological Survey Bulletin No. 38, 82 p.

Overstreet, W.C. and H. Bell, III, 1965. Geologic Map of the Crystalline Rocks of South Carolina: United States Geological Survey Map I-413.

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US EPA, 1987, Data Quality Objectives for Remedial Response Activities: Development Process, EPA/540/G-87-003, March 1987.

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US EPA, 2001. Region IV Environmental Investigations – Standard Operating Procedures and Quality Assurance Manual, May 1996, Revised 2001.

US EPA, 2001, EPA Requirements for Quality Assurance Project Plans, EPA-QA/R-5, March 2001.

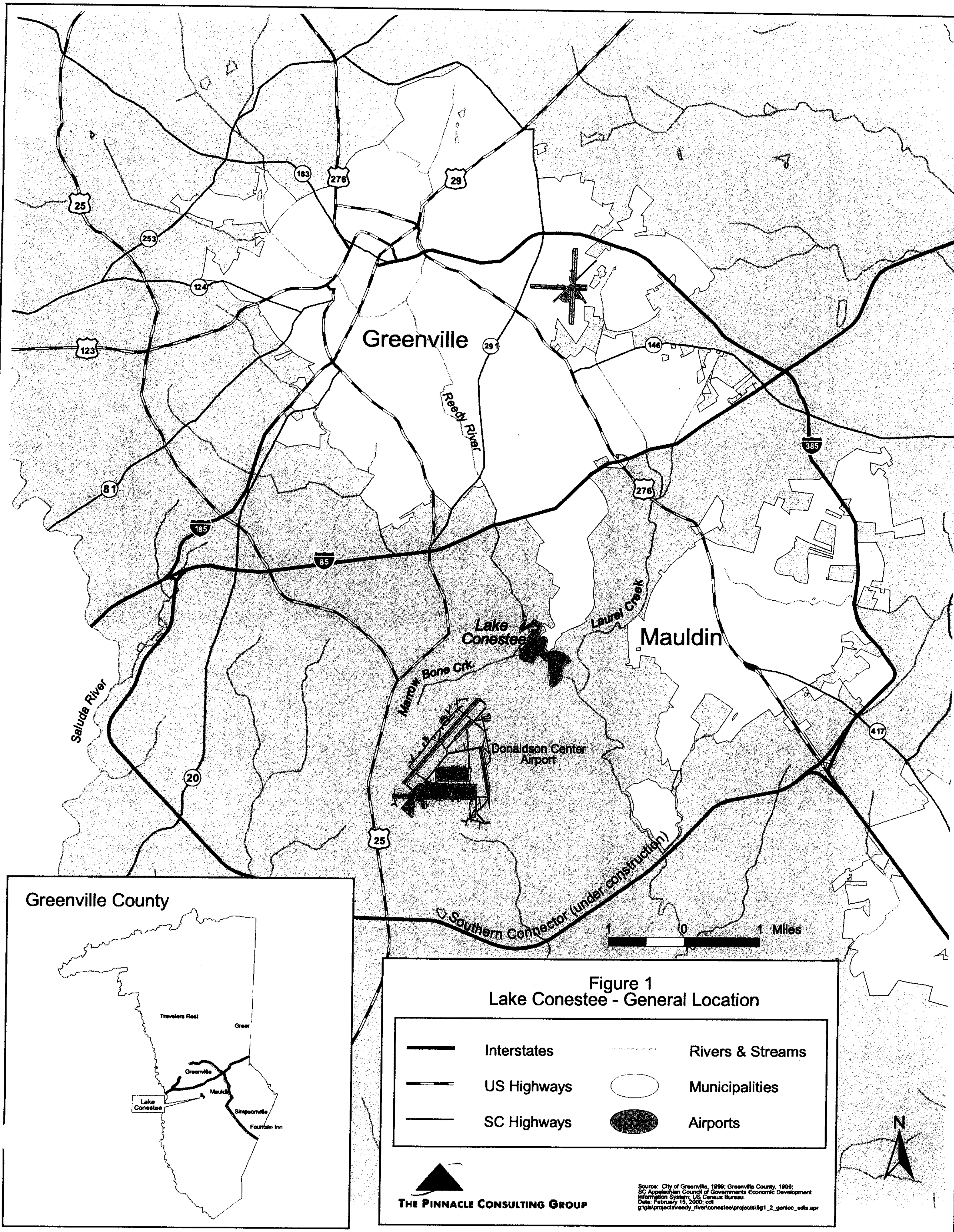


Figure 1
Lake Conestee - General Location

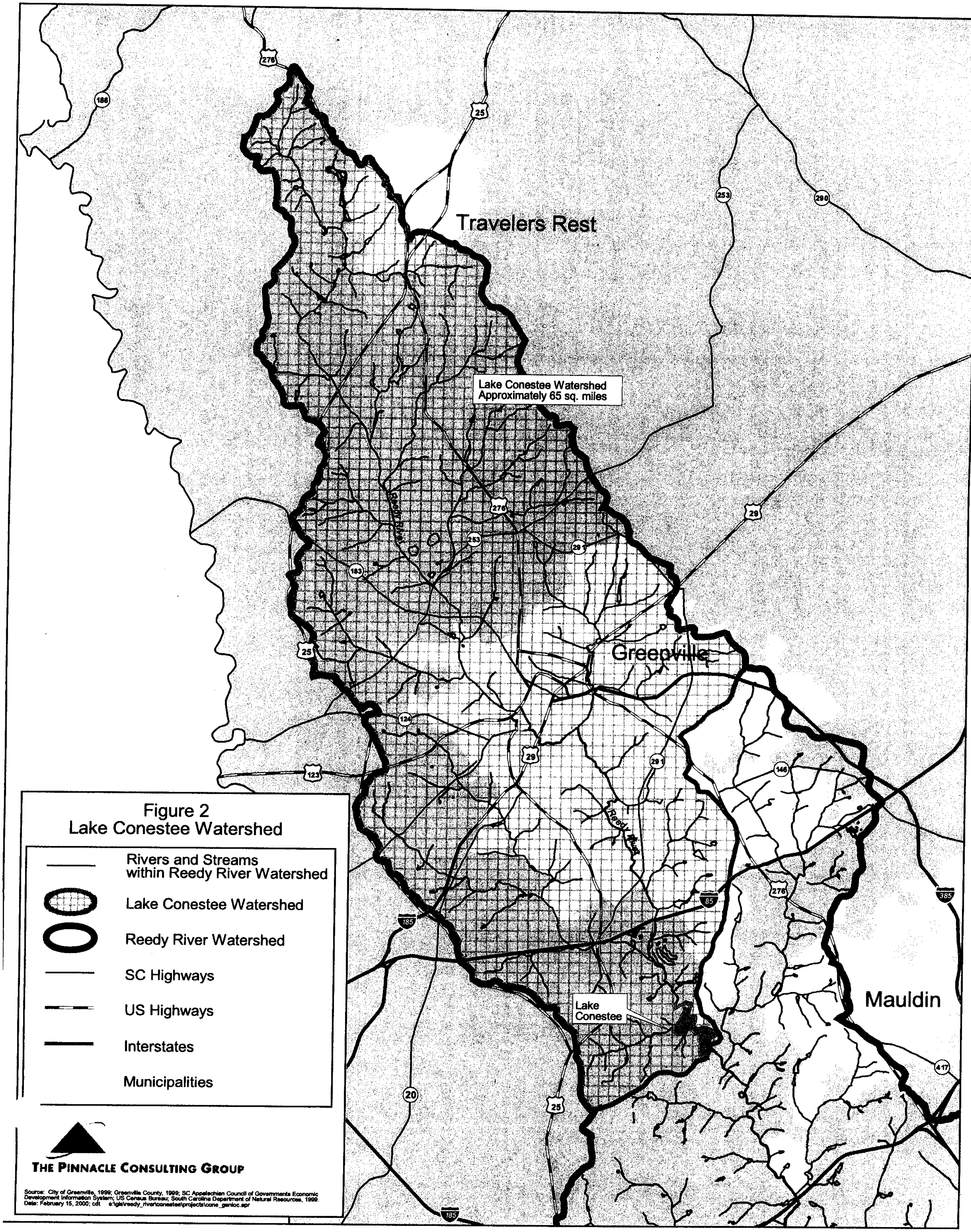


Figure 2
Lake Conestee Watershed

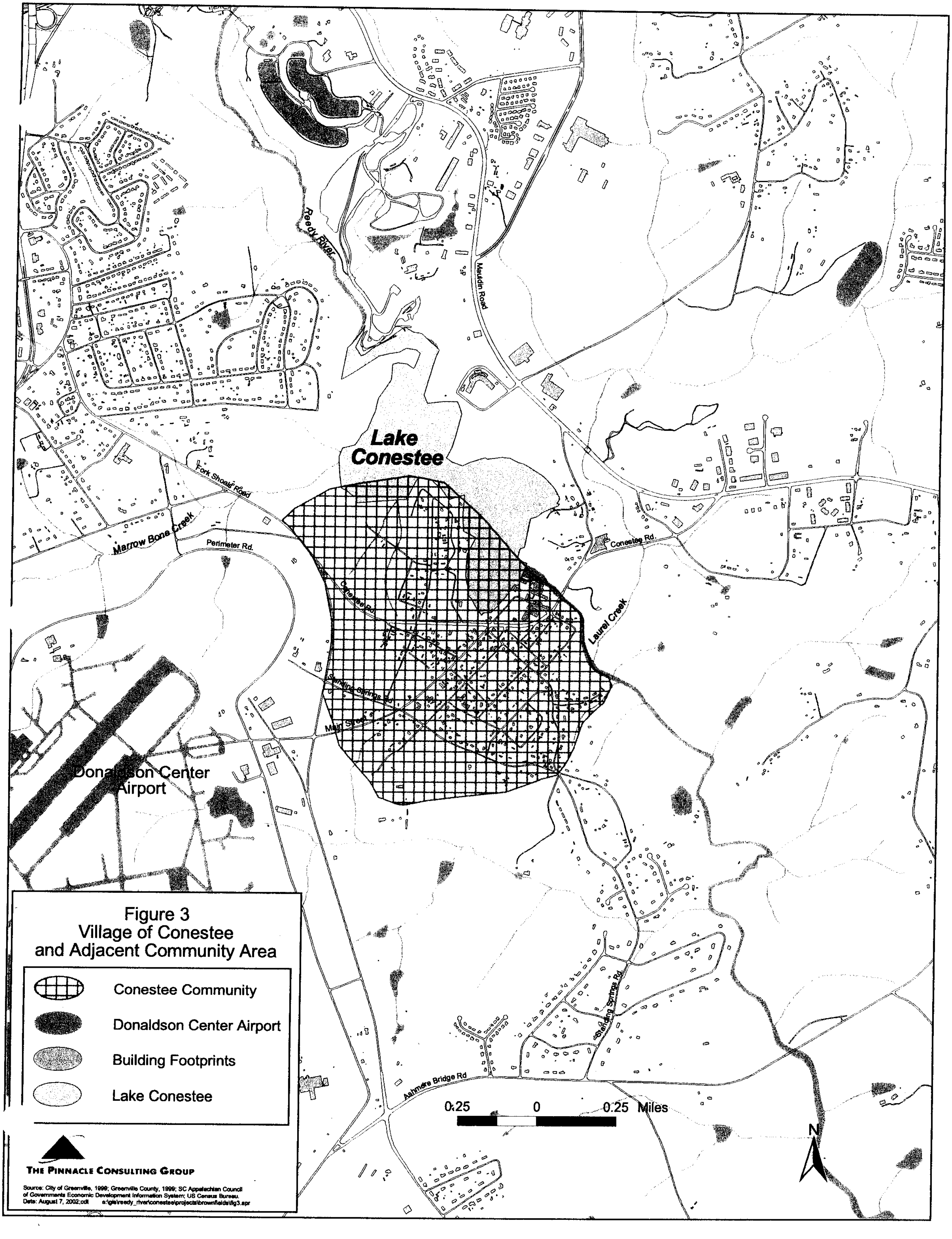


Figure 3
Village of Conestee
and Adjacent Community Area

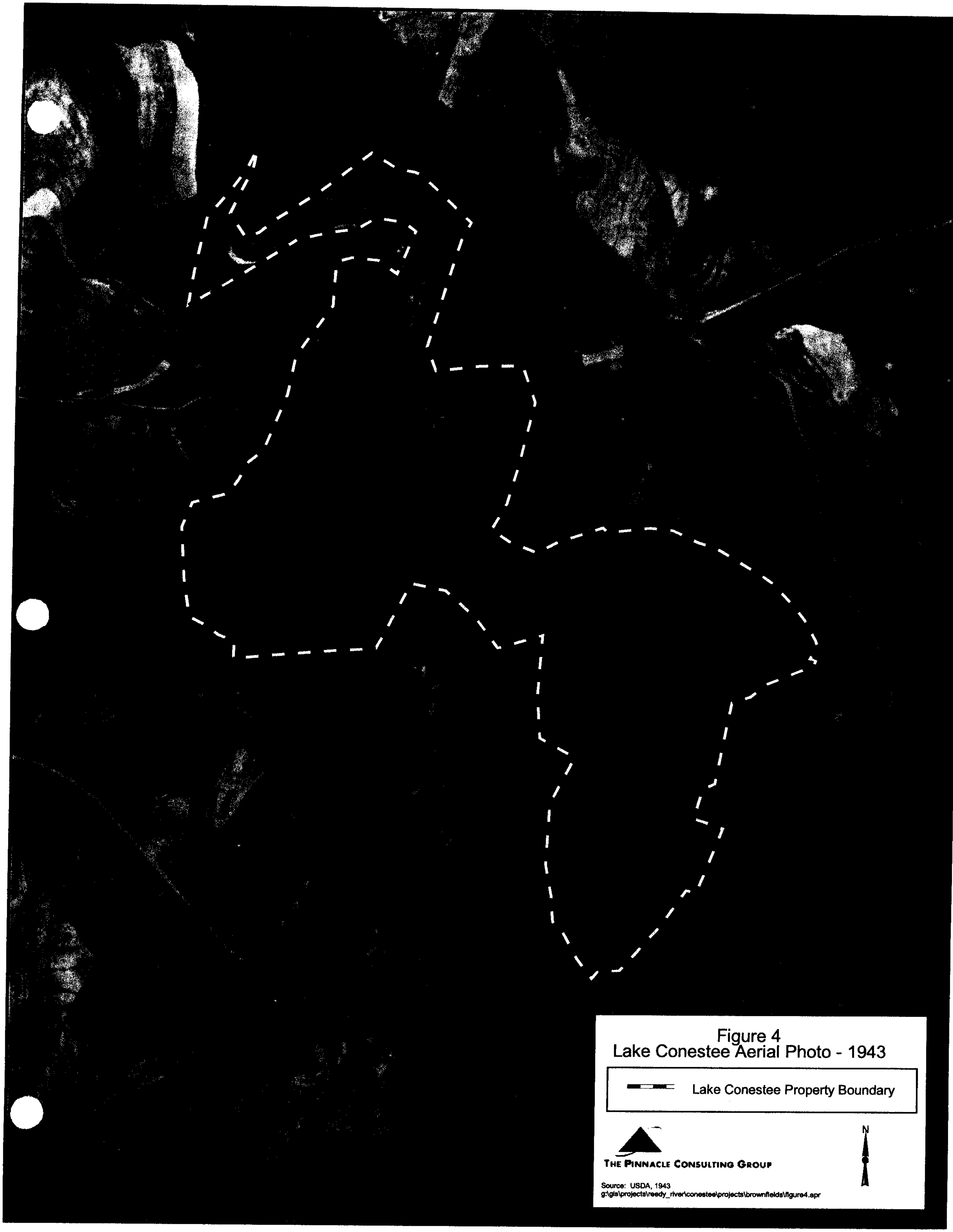


Figure 4
Lake Conestee Aerial Photo - 1943

Figure 5
Lake Conestee Aerial Photo - 1999

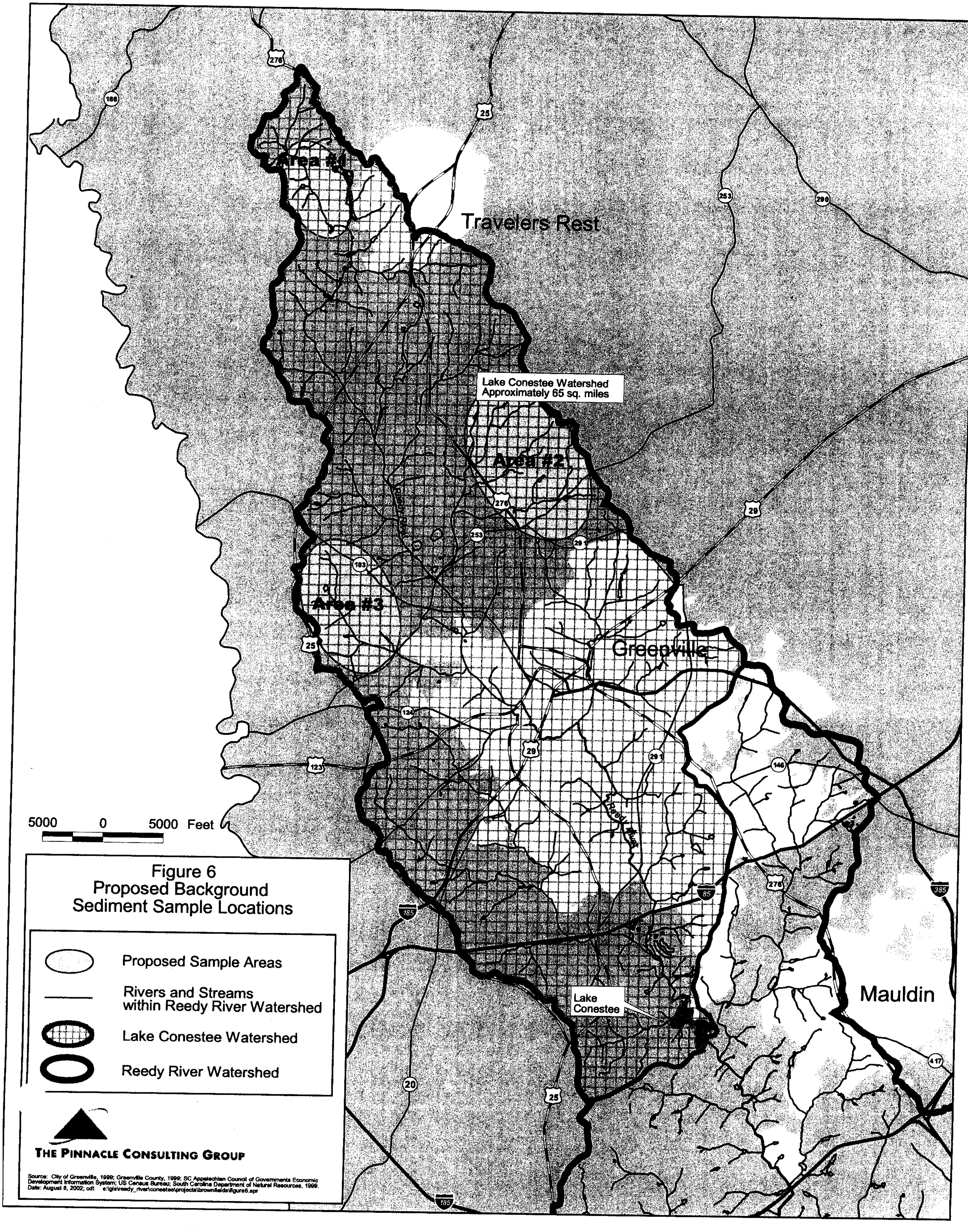


Figure 6
Proposed Background Sediment Sample Locations

Figure 7
Proposed Fish Collection Locations

Source: USGS National Aerial Photography Program, 1999.
Date: August 8, 2002; Creator: cdt
G:/GIS/projects/reedy_river/conestee/projects/brownfields/figure7.apr

Figure 8
Proposed Sediment/Surface Water Sampling Locations: Previously Unsampled Areas

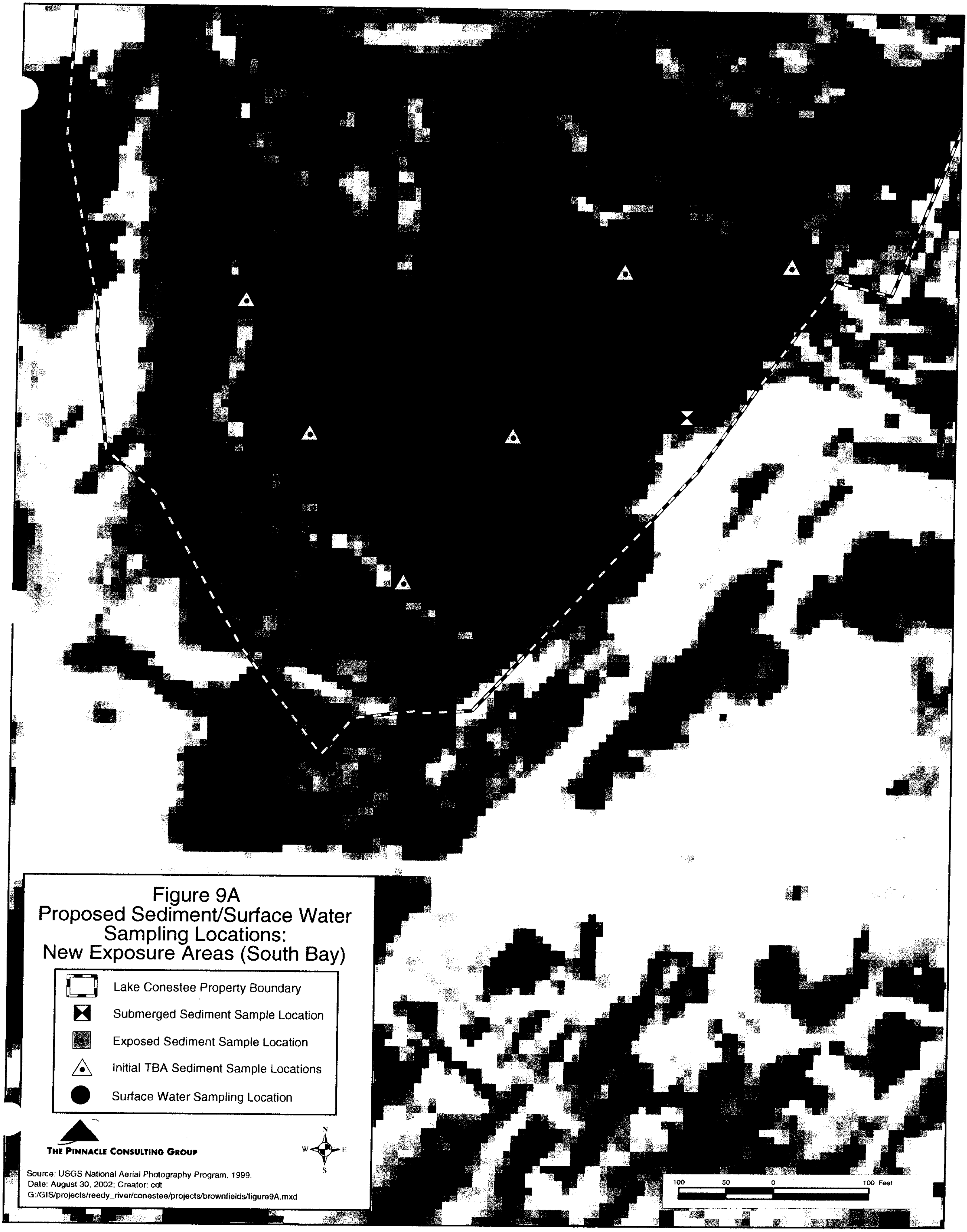


Figure 9A
Proposed Sediment/Surface Water Sampling Locations:
New Exposure Areas (South Bay)

Source: USGS National Aerial Photography Program, 1999.
Date: August 30, 2002; Creator: cdt
G:/GIS/projects/reedy_river/conestee/projects/brownfields/figure9A.mxd

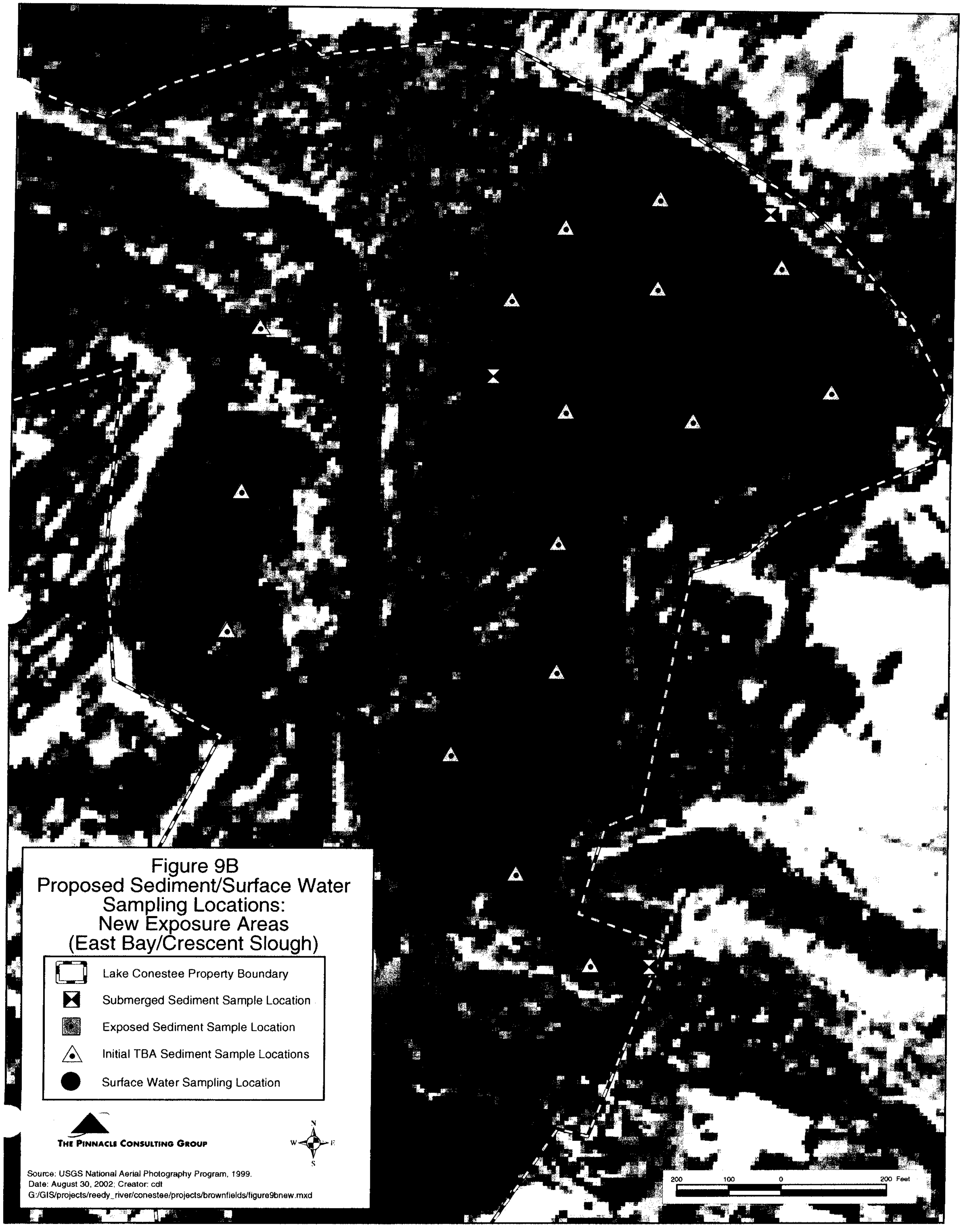


Figure 9B
Proposed Sediment/Surface Water Sampling Locations:
New Exposure Areas
(East Bay/Crescent Slough)

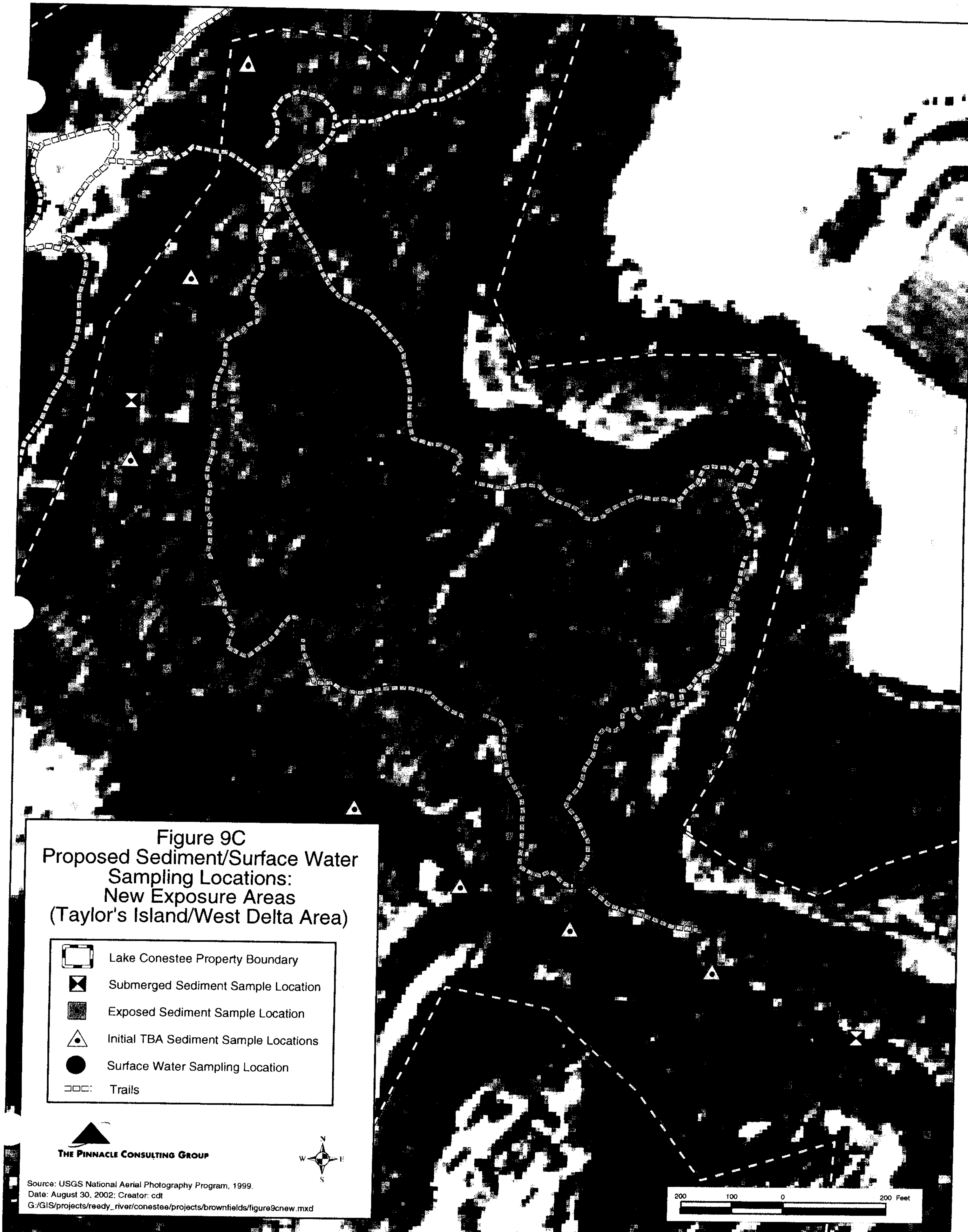


Figure 9C
Proposed Sediment/Surface Water Sampling Locations:
New Exposure Areas
(Taylor's Island/West Delta Area)

Figure 10
Zapata/Pinnacle Project Team
Follow-Up Investigation Activities
Lake Conestee, Greenville County, South Carolina

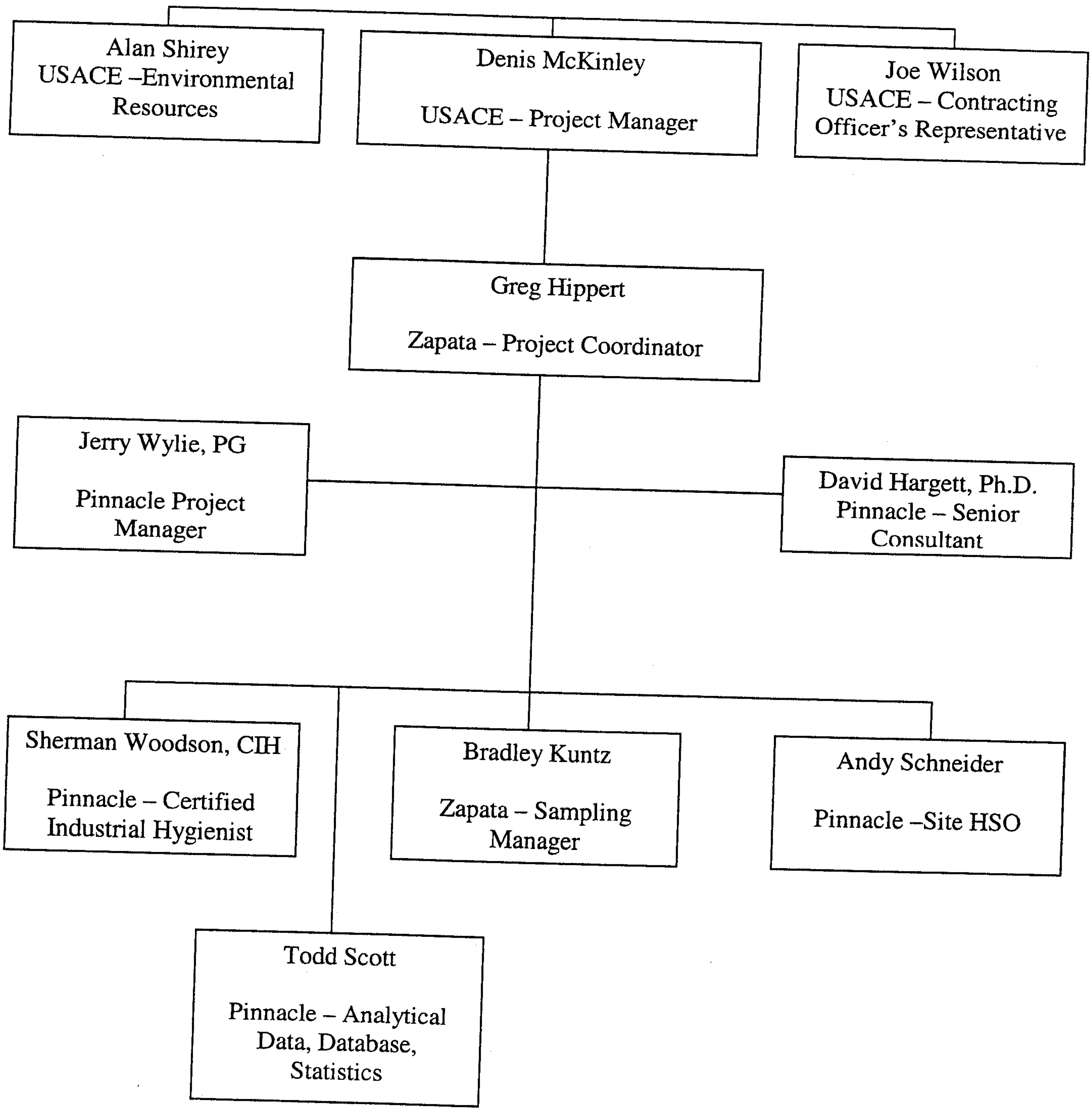
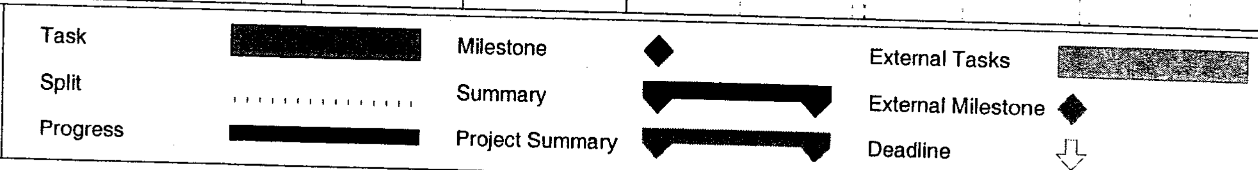


Figure 11
Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee, Greenville, South Carolina

ID	Task Name	Duration	Start	Finish
1	**Notice to Proceed**	**1 day**	**Fri 7/12/02**	**Fri 7/12/02**
2	**Workplan Addendum**	**65 days**	**Sat 7/13/02**	**Sun 9/15/02**
3	**Draft Workplan Addendum**	**30 days**	**Sat 7/13/02**	**Sun 8/11/02**
4	Develop Draft Workplan Addendum	25 days	Sat 7/13/02	Tue 8/6/02
5	Internal Review & Packaging	4 days	Wed 8/7/02	Sat 8/10/02
6	Submit Draft Workplan Addendum	1 day	Sun 8/11/02	Sun 8/11/02
7	Review Draft Workplan Addendum	15 days	Mon 8/12/02	Mon 8/26/02
8	**Final Workplan Addendum**	**10 days**	**Tue 8/27/02**	**Thu 9/5/02**
9	Develop Final Workplan Addendum	7 days	Tue 8/27/02	Mon 9/2/02
10	Internal Review & Packaging	2 days	Tue 9/3/02	Wed 9/4/02
11	Submit Final Workplan Addendum	1 day	Thu 9/5/02	Thu 9/5/02
12	Approve Final Workplan Addendum	10 days	Fri 9/6/02	Sun 9/15/02
13	**Complete Site Assessment (Field Work)**	**60 days**	**Mon 9/16/02**	**Thu 11/14/02**
14	**Site Assessment Report**	**80 days**	**Fri 11/15/02**	**Sun 2/2/03**
15	**Submit Draft Assessment Report**	**45 days**	**Fri 11/15/02**	**Sun 12/29/02**
16	Develop Draft Assessment Report	40 days	Fri 11/15/02	Tue 12/24/02
17	Internal Review & Packaging	4 days	Wed 12/25/02	Sat 12/28/02
18	Submit Draft Assessment Report	1 day	Sun 12/29/02	Sun 12/29/02
19	Review Draft Assessment Report	15 days	Mon 12/30/02	Mon 1/13/03
20	**Final Assessment Report**	**10 days**	**Tue 1/14/03**	**Thu 1/23/03**
21	Develop Final Assessment Report	7 days	Tue 1/14/03	Mon 1/20/03
22	Internal Review	2 days	Tue 1/21/03	Wed 1/22/03
23	Submit Final Assessment Report	1 day	Thu 1/23/03	Thu 1/23/03
24	Approve Final Assessment Report	10 days	Fri 1/24/03	Sun 2/2/03

Date: 6/25/02
DACA21-02-D-0006-0001



APPENDIX A

FIELD SAMPLING AND ANALYSIS PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

This document establishes the Field Sampling and Analysis Plan (FSAP) for performing a follow-up investigation at the Lake Conestee site in Greenville, Greenville County, South Carolina. This document will be used in conjunction with the QAPP to conduct the assessment.

The purpose of the FSAP is to establish data collection activities, which are compatible with the DQOs identified in the Work Plan and to provide a mechanism for planning and approving field activities. The scope of work is intended to initially document the presence, nature, and extent of affected media. The FSAP provides guidance for the field work by defining the sampling and data-gathering methods to be used. The types of samples to be collected are fish tissue, surface soil, surface water, and sediment. Duplicate samples, field blanks, and trip blanks will be utilized as methods of QA and are discussed in the QAPP. Laboratory QA samples, such as matrix spikes and matrix spike duplicates, are also discussed in the QAPP. Sampling methods, chain-of-custody, preservation and equipment procedures used to perform the work activities described in the Work Plan will comply with the US EPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001).

2.0 SAMPLE CONTROL, FIELD RECORDS, AND DOCUMENT CONTROL

This section presents procedures for sample control, field records, and document control. Sample control includes sample identification and chain-of-custody procedures. A sample is defined as physical evidence collected from a facility, site, or from the environment.

2.1 SAMPLE DESIGNATION

The method of sample identification used depends on the type of sample collected. Samples collected for specific field analyses or measurement data are recorded directly in bound logbooks (field books). Standard sample labels, which are attached to the sample containers, will be used to identify samples collected for laboratory analysis. Sample labels will be completed using waterproof, non-erasable ink. Each sample will be assigned a unique alphanumeric sample descriptor that identifies the sample type, sample area, sample site number, and sample interval, (if applicable). As an example, WEST BAY-SED-01 (4-5) would indicate the West Bay area, sediment sample #1 from a depth interval of four to five feet. The first group of letters specify the sample area location, the next set of letters specify the media type (e.g., SED for sediment, SW for surface water, SOIL for soil, and FISH for fish tissue), followed by the sample numbers presented sequentially from the first sample to the last, and other descriptive data where appropriate, such as the depth range across which the sample was collected. Anticipated sample areas are:

- WEST BAY: Beaver-impounded areas in the western portion of the site and Marrow Bone Creek;
- RIVER REEDY: Upstream reaches of the Reedy River;
- UPSTREAM: Upstream areas of the property north of Taylor's Island to the upper property boundary;
- EAST BAY: The easternmost inundated portion of the property;
- SOUTH BAY: The southernmost inundated portion of the property;
- CRESCENT SLOUGH: The crescent-shaped slough located in the south-central portion of the property; and
- TAYLORS ISLAND: The former lake island located in the north-central portion of the property that rises topographically above the area.

2.2 CHAIN-OF-CUSTODY PROCEDURES

Chain-of-custody procedures are established to maintain sample custody and documentation of samples for evidence. The possession of samples must be traceable from the time of collection to its introduction into evidence. Chain-of-custody procedures shall follow procedures as outlined in Section 3.0 of the QAPP.

The unique sample identification numbers discussed above will be included on the chain-of-custody form used to track the sample container. Duplicate samples will be given unique sample identification numbers and will be noted in the field book. This requirement does not apply to blind-spiked or blank samples, which are to be submitted for laboratory quality control purposes. Blind-spiked or blank samples shall not be identified as such.

Chain-of-custody forms must accompany all sample containers to document the transfer of the containers and samples from the originating laboratory, through the field collection, and to the laboratory receiving the samples for analyses. A sample container is under custody if:

1. It is in the field investigator's actual possession;
2. It is in the field investigator's view, after being in his/her physical possession; and/or
3. It was in the field investigator's physical possession and then she/he secured it to prevent tampering.

Each set of containers is shipped with a chain-of-custody form, which travels with the sample containers. A copy of the chain-of-custody form with its unique numbers of the samples that it tracks shall be kept in the laboratory to help identify lost or missing samples. If a sample chain-of-custody is lost in shipment, the field investigation will prepare a written statement detailing the pertinent information including the following:

- where and how the sample was collected,
- field book entries regarding the sample, and
- how and when the sample was shipped.

The role and responsibilities of the project/field personnel are delineated in the QAPP.

2.3 FIELD RECORDS

Documentation of an investigative team's field activities provides the basis for technical site evaluations and related written reports. Additionally, all records and notes generated in the field may be considered as evidence and may potentially be subject to scrutiny in litigation. It is essential that all field documentation provide a clear, unbiased picture of field activities. All aspects of sample collection and handling, as well as visual observations, shall be documented in the field books.

Bound field books will be used on work assignments requiring field activities. Entries into field books will be legibly written in indelible ink and provide a clear record of all field activities.

The following information must be provided on the inside front cover or first page of the field notes:

- Project Name and Project Manager
- Site Location
- Job Number
- Date

Instructions and procedures relating to the format and technique in which notebook entries are made are as follows:

1. Leave the first two pages blank. They will provide space for a table of contents to be added when the field notes are complete.
2. If photographs are taken as part of the field investigation, a photo description will be made in the notes at the time the photo is taken. Photo descriptions will be numbered sequentially in the notes.
3. Entries shall be made in waterproof ink.
4. Entries shall be made in language that is objective, factual, and free of personal feelings or other terminology, which might prove unclear or inappropriate.
5. Entries shall be printed as neatly as possible.
6. Entries will be logged according to military time.
7. Errors in the field notes will be indicated by drawing a single line through the text. Ensuring that the text is still legible. Initial and date all notations of errors.
8. A new page will be started at the beginning of each day's field activities and the remaining clear page at day's end will be marked out with a single initialed line at the day's end.
9. The person taking notes shall sign, number and date each page.
10. Later additions, clarifications, or corrections must be dated and signed.

Instructions and procedures providing guidance on the information to be recorded on field activities are provided below:

1. A new page should be used at the start of each day's activities. Identify the date, time, job number, location on-site personnel, and observed weather conditions. Changes in weather will be noted when they occur.
2. Include sketches or maps of the site, which can be used to identify photo and/or sample locations. Note landmarks, indicate north, and if possible, include an approximate scale. Include as many sketches and maps as needed.
3. Field personnel responsible for note taking shall log all photos taken in the field in the field book. The photo locations should be referenced to a site sketch or map. Photograph information will include the date, time, location, photographer, sample number, roll number, frame number, and a complete description or identification of the subject in the photograph.
4. Record on-site health and safety equipment used. Describe observed potential hazards to health and safety. Document the level of protection used, decontamination procedure used and specific decontamination solutions daily.
5. As part of the chain-of-custody procedure, sampling information must include sample number, date, time, sampling personnel, sample type, designation of sample as a grab or composite, and any preservative used. Sample locations should be referenced to sample numbers on a site sketch or map.
6. When sampling is complete, the field book entry shall include date, time, sample numbers, and description. Indicate whether or not the sample was a split or duplicate and who received the split or duplicate sample.
7. Information for *in situ* measurements will include a sample ID number, the date, time, and personnel taking measurements. If in-field calculations are necessary, they will be checked in the field and signed by a second team member, whenever possible.
8. If on-site interviews occur, record relevant information obtained. Include names of persons interviewed, the interest group represented (if applicable), address, and phone number.
9. Record any other relevant information, which would be difficult to acquire at a later date.

All project field books are the property of Zapata Engineering/The Pinnacle Consulting Group and will remain in their possession when the project has been concluded. None of the documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies.

2.4 PHOTOGRAPHS

As discussed in the previous section, photographs taken in the field will be documented in the field book. The locations of photographs should be referenced to a site map or sketch. Information in the field book must include the date, time, location, photographer, sample number (if appropriate), roll number, frame number, and a complete description or identification of the subject in the photograph.

After the film is developed, each slide or print should be labeled with, at a minimum, the following information:

- Job identification number
- Date
- Location
- Roll number
- Frame number
- Sample number (if appropriate)

3.0 SAMPLING DESIGN AND PROCEDURES

Samples are collected to obtain a representative portion of the material or medium being sampled. Valid results depend upon using proper sampling, sample handling, and preservation techniques; properly identifying the collected samples and documenting their collection in permanent field records; maintaining sample chain-of-custody; and protecting the collected samples by properly packing and transporting (shipping) them to a laboratory for analysis.

The following factors and procedures shall be considered and/or implemented in planning and conducting sampling operations. These factors and procedures must be considered in view of the specific objectives and scope of the field investigation as presented in the Work Plan and the QAPP.

- Safety of sampling personnel.
- Selection of representative sampling sites.
- Selection and proper preparation of sampling equipment.
- Selection of parameters to be measured and evaluation of sample fractions to be analyzed (e.g., dissolved, suspended or total fractions for water samples).
- Required sample volumes.
- Selection and proper preparation of sample containers.
- Sample preservation.
- Sample holding times.
- Sample handling and mixing.
- Sample identification.
- Transportation and shipping of samples.
- Sample chain-of-custody.

3.1 DEFINITIONS

Grab Sample-An individual sample collected from a single location at a specific time or period of time.

Composite Samples-A sample collected over a temporal or spatial range that typically consists of a series of discrete, equal samples, which are combined or "composited". The types of composite samples include:

Timed Composite-A sample containing a series of discrete samples taken at equal time intervals over the compositing period.

Flow Proportional Composite-A sample containing a series of discrete samples taken proportionally to the flow rate over the compositing period.

Areal Composite-A sample composited from individual grab samples collected over an areal or horizontal cross-section basis. The grab samples shall be of equal volume and shall be collected in an identical manner.

Split Samples-A sample that has been divided into two or more containers from a single sample container. Adequate mixing will be performed such that the two portions of a split sample are, for all practical purposes, identical. The primary purpose of a split sample is to measure sample handling variability.

Duplicate Samples-Two or more samples collected from a common source. The samples are collected simultaneously from the same source under identical conditions into separate containers.

Control or Background Samples-A sample taken in an area known or thought to be free from the COC.

Sample Aliquot-A portion of a sample that is representative of the entire sample.

Trip Blank-A sample which is prepared prior to the sampling event in the actual container and is stored with the investigative samples throughout the sampling event. The trip blank is used as a quality control check for organic compound analyses.

Field Blank-A sample that is prepared in the field to evaluate the potential for contamination of a sample by site contaminants from a source not associated with the sample collected. The sample containers are filled with organic-free deionized water in the field. The deionized water is handled in the same manner as the sample (e.g., if sample is groundwater that has been filtered, the deionized water will be filtered). Field blanks contain the same preservatives as the samples.

Rinsate Blank-A sample of organic-free deionized water that has been passed across the surface of sampling equipment after the equipment has been decontaminated. The rinsate blank is used to check for the effectiveness of the field decontamination procedure between samples.

3.2 DECONTAMINATION PROCEDURES

Decontamination procedures are intended for use by field personnel for cleaning sampling and other equipment in the field. Sampling and field equipment cleaned in accordance with these procedures will meet the minimum requirements for DQO data collection as specified in the QAPP.

Proper decontamination of sampling equipment is essential to prevent cross contamination of samples with the sampling device. All sampling equipment will be decontaminated before sampling and between each sample unless samples are to be composited. Sampling equipment will be decontaminated with materials and procedures specified in the QAPP and according to the following procedures:

- Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.
- Rinse thoroughly with tap water.
- Rinse thoroughly with deionized water.
- Rinse once with propanol if organic compounds are the constituents of concern. Rinse once with 0.1N HCl if inorganic compounds are the constituents of concern. If both organic and inorganic compounds are of concern, the propanol rinse will take precedence.
- Rinse thoroughly with organic-free water and allow to air dry.
- Wrap with plastic to prevent contamination if equipment is going to be stored or transported.

Larger equipment such as drilling and/or backhoe equipment that may contact the samples will be steam cleaned (soap and high pressure hot water). During the field investigation, large equipment such as drill augers and bits will be steam cleaned. Sampling equipment such as split barrel samplers will be decontaminated according to the procedure describe above.

Tap water (potable) will be used for steam cleaning and will be obtained from the local public water supply. The public water supply will be sampled during the field investigation and analyzed for the organic compound fraction of the Target Compound List (TCL) list and for metals.

Spent decontamination fluids will be contained in steel 55 gallon drums and a random sample will be analyzed for VOCs, SVOCs, TAL metals, organo-chlorine pesticides, and PCBs. Disposal of the decontamination fluids will be based on the results of the analyses. Water IDW resulting from decontamination of equipment (i.e., “decon” water) should be collected and temporarily stored on–site (temporary storage not to exceed 45 days from completion of field work).

4.0 ENVIRONMENTAL SAMPLING

4.1 GENERAL CONSIDERATIONS AND SAMPLE LOCATIONS

Selection of a sampling location is based on many factors, including study objectives, water use, point source discharges, location and nature of tributaries, changes in stream characteristics, types of streambed, stream depth, turbulence, depositional environment, presence of structures (weirs, dams), and accessibility. Sampling sites on streams should be located in areas of the greatest cross sectional homogeneity. Since mixing is principally governed by turbulence and water velocity, the selection of a site immediately below a ripple area will ensure good vertical mixing. These locations are also likely areas for sediment deposition since the greatest deposition occurs where stream velocity decreases. Horizontal (cross channel) mixing occurs in constrictions in the channel, but because of velocity increases, the stream bottom may be scoured, and therefore, a constriction is a poor sediment sample location. Typical sediment deposition areas are located on the inside of river bends, downstream of islands, and downstream of obstructions in the water.

The selection of sampling station locations include, at a minimum, the following considerations:

- Time of water travel, not distance,
- Marked physical changes in the stream channel,
- Upstream and downstream relationships to target tributaries, discharges or investigation sites,
- Point-source waste discharge or tributary lateral mixing distance,
- Non-point source discharges, and
- Flow patterns at the months of tributaries and possible mixing with the main channel.

Seasonal variations will also be considered since water quality and sediment depositional areas may be strongly influenced by changing flow rates. This is also an important consideration when comparisons with other investigations are anticipated.

It is anticipated that the following samples will be collected:

- Lake Conestee Sediments - Shallow sediments will be collected from both inundated areas as well as areas of exposed sediment accumulation. Sediments will be collected from the top two feet with any vegetation discarded. Samples will be collected from five lake areas:

- West Bay/Marrow Bone Creek – 15 samples
- Upstream Lake – 10 samples
- Crescent Slough – 1 sample
- Taylor's Island/West Delta – 13 samples
- East Bay – 8 samples
- South Bay – 3 samples

- Lake Conestee Surface Water - Surface water samples will be collected from the water column in the inundated areas of the lake. Samples will be collected from five lake areas:

  - West Bay/Marrow Bone Creek – 5 samples
  - Upstream Lake – 5 samples
  - Crescent Slough – 1 sample
  - Taylor's Island/West Delta – 2 samples
  - East Bay – 4 samples
  - Reedy River adjacent to East Bay – 1 sample
  - South Bay – 2 samples

- Fish Tissue - Ten fish will be collected from various habitats in Lake Conestee. The number of fish to be collected from each habitat is based on a distribution of the 10 allotted samples relative to the size of the habitat:

  - East Bay - 3 fish
  - South Bay - 2 fish
  - Reedy River - 3 fish
  - West Bay/Marrow Bone Creek – 2 fish

- Background Soil - Three surficial soil samples, collected from 6 to 12 inches in depth, will be taken from Taylor's Island from areas of the former island above historic inundation elevation.

- Reedy River Sediments - Three sediment samples will be collected from natural sediment accumulation environments miles upstream of Lake Conestee. Three composite sediment samples will be collected from three distinct locations. At each location, three separate sediment aliquots will be homogenized into a single, composite sediment sample that will be submitted for analysis representing that specific sample location. All three samples will be collected from the Reedy River or its tributaries upstream of the influence of the City of Greenville. The top two feet of sediment will be collected with any vegetation discarded prior to sample collection/compositing.

4.2 SURFACE WATER SAMPLING EQUIPMENT/TECHNIQUES-LAKE CONESTEE

For all sampling activities, the equipment or sampling techniques must not cause the integrity of the sample to be compromised and should provide a sample which is representative of the medium being sampled.

Samples from surface waters will be collected directly into sample containers (unpreserved bottleware) or decanted from a precleaned, location-dedicated container into the bottleware containing preservative. If accessible the sampler will stand along the edge of the lake or wade into the water, taking care to disturb bottom sediments as little as possible. Where inaccessible, a boat will be used to access the sample location.

4.3 SAMPLING EQUIPMENT/TECHNIQUES-DRY SEDIMENT/SOIL SAMPLES

Manual techniques and equipment used for subsurface soil sampling, such as hand augers, are usually used for surface or shallow, subsurface soil sampling. Power operated equipment is usually associated with collecting deep samples, but this equipment can also be used for collecting shallow samples when the auger hole begins to collapse, or when the soil is so tight that manual auguring is not practical.

Dry sediment/soil samples will be collected using a stainless steel hand auger. The samples will be collected from a depth range of surface to 12 inches with any vegetation discarded. The remaining sample aliquot will be placed into a stainless steel bowl for mixing, where appropriate. Soil samples for VOC analysis will be collected directly according to the procedures specified in SW-846 Method 5035 (US EPA, 1992).

4.4 SEDIMENT SAMPLING EQUIPMENT/TECHNIQUES-INUNDATED SAMPLES

Sediment samples collected from Lake Conestee will be comprised of samples from shallow inundated areas or samples from deeper inundated areas such as sloughs and beaver-impounded areas. For the shallow areas, either a stainless steel scoop or hand auger may be used to collect the sediment sample as described in Sections 4.3 and 4.5. For sample collection in deeper inundated areas, a stainless steel, sediment tube corer will be used. The sediment corer will be pushed through the water column and into the sediment. Sediment is then pushed directly into a 20-inch-long, two-inch-diameter, polyethylene sleeve that is fixed inside the stainless steel corer. Upon retrieval, a flap on the top of the device, which allowed surface water to escape during descent, prevents sample loss upon ascent. Any vegetation will be discarded, and the remaining sample aliquot will be placed into a stainless steel bowl for mixing, where appropriate. Soil samples for VOC analysis will be collected directly according to the procedures specified in SW-846 Method 5035 (US EPA, 1992).

4.5 SEDIMENT SAMPLING EQUIPMENT/TECHNIQUES-RIVER SAMPLES

The Reedy River sediment samples will be collected using a stainless steel scoop/spoon or sediment corer as described in Section 4.4. In the scooping method, precautions will be taken to make the collected sample as representative of the sediment as possible.

The sampling devices will be decontaminated between each sample or clean equipment will be used for each sample. The samples will be collected upstream of the sample collector. Pebbles or cobbles greater than 5-mm diameter and vegetation will be removed from the sample prior to filling in the appropriate containers directly from the sampler. Subsamples will be composited in a decontaminated, stainless steel or bowl if a single scoop does not provide sufficient sediment volume to fill the required sample bottles.

4.6 FIELD ANALYTICAL TECHNIQUES-SURFACE WATER

Conductivity, temperature, and pH measurements will be collected for surface water samples. Instrument calibration will be conducted in accordance with manufacturer's specifications. Calibration information and dates will be recorded in the field book.

4.7 FISH TISSUE COLLECTION TECHNIQUES

Fish for tissue analysis will be collected with a backpack electroshocker by a licensed fisheries biologist experienced in conducting this type of sampling. Observations will be made and recorded relative to the number of individuals observed, the species of fish observed, the relative sizes of the individuals, and any abnormalities associated with individuals. Sampling preference will be given to (1) species type: catfish preferred over bass preferred over pan fish, and (2) size of individual with a sampling preference for the largest individual. Collected fish will be measured, weighed, identified to species level, contained in aluminum foil and labeled, sealable bags, and placed on wet ice immediately. The samples will be scaled and filleted after sample collection. Fillets will be contained in aluminum foil and labeled, sealed bags and placed on wet ice.

The electroshocker cannot be decontaminated according to standard practices due to the electrical components of the device. Gross decontamination will be conducted to remove mud or other debris from the probes. Equipment that will directly contact the tissue sample (e.g., measuring board, fillet knife, and scaler) will be decontaminated between each tissue preparation according to the procedures described in Section 3.2.

4.8 FIELD MAPPING AND SURVEYING

All sampling locations utilized during the field investigations will be surveyed and depicted on a scaled drawing, topographic or other standard map, or be referenced in such a manner that their location(s) are firmly established. Surveying will be conducted using GPS with an accuracy of +/- 10 feet. Taking accurate, complete, and informative field notes in surveying is a prime objective. The field notes are the only reliable record of measurements made and information gathered in the field. Survey information gathered will be recorded in the field on bound field notebooks. Notes will be permanent, legible, and complete and will be made with an indelible, waterproof ink pen.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

This Addendum to the Quality Assurance Project Plan (QAPP) has been prepared for the activities associated with the Targeted Brownfields Assessment follow up investigation at Lake Conestee. The QAPP presents the details of the policies, organization, objectives, QA activities, and QC activities that are intended to achieve the DQOs of the investigation. This Addendum to the QAPP is to be used in conjunction with the addenda to the FSAP and Work Plan prepared for the Lake Conestee follow-up investigation.

The activities conducted in association with the Lake Conestee Follow-up Investigation will be consistent with Test Methods for Evaluating Solid Waste – Physical/Chemical Methods (SW-846; US EPA, 1992). This QAPP has been developed according to the following guidance documents:

- EPA Guidance for Preparing Quality Assurance Project Plans (US EPA, 1998),
- EPA Guidance for the Data Quality Objectives Process (US EPA, 2000),
- EPA Requirements for Quality Assurance Project Plans (US EPA, 2001), and
- Region IV Environmental Investigations-Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001).

2.0 PROJECT MANAGEMENT

The major roles and personnel assigned for the Lake Conestee follow-up investigation are shown in Figure 1.

2.1 DISTRIBUTION LIST

This Addendum to the QAPP will be distributed along with the addenda to the Work Plan and FSAP.

2.2 PROJECT ORGANIZATION AND ROLES

The investigation will be managed according to the line of authority described in this section. The project position and associated responsibilities are described in the following paragraphs.

This project is being conducted under Delivery Order DACW60-00-D-0002. An organizational chart with the project team is included as Figure 10. The A-E's project manager shall oversee the coordination and execution of the entire project.

Greg Hippert will serve as the Zapata Engineering (A-E) and overall project coordinator. In this role, he will coordinate the work elements that the A-E will implement, assist as needed in and supervise the field efforts, assist with data review and evaluation, and will prepare relevant sections of the final report. Mr. Hippert will provide support for the Site Health and Safety Officer. He will be responsible for overall administrative program management, communication with the USACE, and resource allocation for Zapata.

Jerry A. Wylie, P.G. will serve as the Pinnacle Consulting Group project manager and certifying South Carolina Professional Geologist of record for the project. In this role, he will coordinate the work elements that Pinnacle will implement, assist Zapata Engineering with the work elements for which Zapata will have primary responsibility, assist in the field efforts, assist with data review and evaluation, and will coordinate submittals to the appropriate parties. Mr. Wylie will both participate in and supervise the data gathering efforts and will be on site for a representative portion of the field activities. He will be the primary writer of the final report. Mr. Wylie will be responsible for overall administrative project management and resource allocation for Pinnacle.

Bradley Kuntz will serve as the A-E's sampling and field operations manager. Mr. Kuntz will be responsible for the planning and implementation of the field effort.

David L. Hargett, Ph. D., CGWP, CPSS will serve as a Senior Consultant and liaison with the site owner, The Conestee Foundation. In these roles, he will be a primary communication contact for all parties. In addition, he will be involved in technical aspects of the effort to ensure that the overall goals of the effort are attained. Dr. Hargett has spent hundreds of hours on Lake Conestee and has unequaled knowledge of the site. Dr. Hargett will be a primary QA/QC reviewer.

Andy Schneider will serve as the Site Health and Safety Officer (HSO). His primary role will be to ensure the compliance of all site workers/visitors with the SSHP.

Sherman Woodson, CIH, will serve as the Certified Industrial Hygienist for the project. He will prepare the SSHP and will ensure its conformance to USACE requirements. He will support the Site HSO in ensuring conformance with the SSHP.

Todd Scott will serve as the Database Manager. He will review all analytical data for accuracy and completeness and conduct a data validation assessment. In addition, he will provide support relative to statistical analysis of data.

2.3 PROBLEM DEFINITION

The objectives of this phase of the TBA are to assess releases of hazardous substances onto the property that could impact its use as a community greenspace and environmental education facility. The results of this phase of investigation will also assist in determining the need for cleanup or control measures to protect human health and the environment. Assessment activities include data gathering and analysis to evaluate the nature and general extent of residual contaminants-of-concern. The data must be of sufficient quality and quantity to support subsequent site-related activities (e.g., use as a greenspace, remedial actions, etc.).

2.4 GENERAL PROJECT DESCRIPTION AND SCHEDULE

An follow-up investigation of the nature and general extent of residual chemical impact to the soils, sediments, and surface waters of Lake Conestee will be conducted. Direct sampling and chemical analysis of environmental media will be used to develop assessment data. Based on the data derived from this assessment, decisions can be made concerning the site's usability and/or the need for further investigation or remediation.

The schedule for implementation of the follow-up investigation is included as Figure 2. The schedule is a timeline of activities and milestone events associated with implementation of the investigation.

2.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The Work Plan and a FSAP were prepared separately. Section 4.0 of the Work Plan discusses the development of DQOs according to the US EPA's recent guidance (US EPA, 2000). The DQO development process involves the following steps:

1. State the Problem
2. Identify the Decision
3. Identify Inputs to the Decision
4. Define the Study Boundaries
5. Develop a Decision Rule
6. Specify Limits on Decision Errors
7. Optimize the Design for Obtaining Data

2.6 DOCUMENTATION AND RECORDS

In summary, data will be collected in the field or in the laboratory and will be transferred to an appropriate summary form. The appropriate team member as designated by the Project Manager will validate (i.e., check the completeness and accuracy) all data generated. The validated data will be compiled and reported according to the project schedule.

2.6.1 Field Data

Field data will be recorded on data collection sheets or directly in a field log book. Data to be recorded includes visual observations, chemical analysis (e.g., pH, conductivity, temperature, etc), and physical measurements (e.g., sample depth, sample location etc). Field personnel will evaluate this information at the time of collection for accuracy based on instrument response, calibration results, and related measurements where applicable. Data that appears to be an outlier will be confirmed by a second measurement or by recalibration of the instrument where possible. In the event of an instrument malfunction, a replacement instrument will be utilized where possible. Any questionable results identified by the sampling personnel will be noted as such and evaluated further by the QA/QC team. An additional review of the field data will be performed by the Project Manager after the data have been finalized and submitted by the field personnel. This validation review will include confirmation of appropriate frequency and procedures for calibration, completeness of the data, and appropriate documentation of the measurements. Any datum that is identified as not meeting the QC criteria will flagged appropriately based on the severity of the deviation from the criteria. If necessary, the datum will be declared invalid and will not be used for any subsequent calculations or decision-making processes. If invalidated data are considered critical, the Project Manager may require re-measurement.

Analytical results for field measurements will be available immediately. Records associated with the field measurements (e.g., field log books, field data collection sheets, etc) will be retained for a minimum of 10 years.

2.6.2 Laboratory Data

Laboratory data will be recorded according to the analytical laboratory's standard procedures. The laboratory's QA/QC program addresses the procedures for evaluating the validity of the data being generated, and the response to be taken in the event the QC criteria are not met. A copy of the laboratory's SCDHEC laboratory certification and quality systems manual is attached to this QAPP as Attachment 1. The laboratory will assign flags to data that do not meet all QA parameters to indicate possible reduction in data quality. These flags along with an explanation of their meaning will appear with the data in any summary tables or other reports that include the data. An additional review of the laboratory data will be performed after the data have been received. This validation review will include an assessment of data quality indicators to determine the data usability. The five common data quality indicators that will be evaluated are precision, accuracy, representativeness, completeness, and comparability. The indicators are commonly referred to as the PARCC parameters. These indicators are assessed through field and laboratory QC samples and other procedures. Each is discussed in the following paragraphs.

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is the quantitative measure of the variability of a group of measurements compared to the average value. The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision. Sampling precision may be determined by collecting and analyzing replicate field samples. The analytical results from laboratory replicates provide data on analytical precision. Subtracting the analytical precision from the measurement precision defines the sampling precision.

Accuracy measures the bias in a measurement system. Accuracy is difficult to measure for the entire data collection activity. Sources of error are the sampling process, cross contamination, preservation, sample handling, sample matrix, sample preparation, and analysis techniques. Analytical accuracy is assessed through use of known and unknown QC samples and spike samples. Accuracy determinations by known samples include single control and duplicate control samples, commonly referred to as laboratory control samples. These are samples made up of reagent grade water that is spiked with known amounts of target compounds. Percent recovery and percent difference parameters are determined from these samples. Analytical accuracy determinations by unknown samples include the evaluation of matrix interferences in the environmental samples. These samples also provide percent recovery and percent difference parameters through the use of surrogate and matrix spikes in the environmental samples.

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Making certain that sampling locations are selected properly and a sufficient number of samples are collected best satisfies the representativeness criterion.

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is essentially the same for all data uses: that a sufficient amount of valid data be generated. It is important that critical samples are collected and valid data achieved for them.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. Comparability is limited to the other PARCC parameters because comparisons between data sets require known precision and accuracy.

The laboratory data will be evaluated using the PARCC parameters to the extent possible based on available information. Any datum identified as not meeting the QC criteria will be flagged appropriately based on the severity of the deviation from the criteria. If necessary, the datum will declared invalid and will not be used for any subsequent calculations or decision making processes. If invalidated data are considered critical, the Project Manager may require re-analysis if there is sufficient sample remaining within the required holding time or recollection and analysis.

Analytical results for the laboratory analysis are expected to be available within 21 days of sample collection. Complete Level III data packages are expected to be received within 14 days after receiving the analytical results. The analytical reports and data packages will be retained for a minimum of 10 years.

3.0 MEASUREMENT AND DATA ACQUISITION

This section presents information related to measurement and data acquisition that is not contained in other related documents. Where the required information is contained in another document, the appropriate reference is provided.

3.1 SAMPLING PROCESS DESIGN

The sampling process design is provided in Section 2.1 of the FSAP.

3.2 SAMPLING METHOD REQUIREMENTS

Sample quality will be ensured through the use of appropriate sampling techniques, containers, and handling procedures. The FSAP was prepared according to the US EPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001). Descriptions of sampling methods for each media to be sampled are included in the following sections of the FSAP:

- Surface Water — Section 4.2
- Sediment — Section 4.3, 4.4, and 4.5
- Fish Tissue — Section 4.7
- Soil — Section 4.3

Samples will be collected from locations that are intended to provide information about background and on-site levels of analytes. The sample locations chosen and the numbers of samples from each medium are presented in the FSAP.

Table 1 presents the sample containers, preservatives, and holding times for each group of analytes. Precleaned sample containers will be obtained from the analytical laboratory along with the appropriate preservatives. Sample containers will be secured from the time of receipt from the laboratory, through collection, and until the time of delivery to the laboratory or courier.

Sample custody is presented in Section 3.3 of this QAPP. Procedures for sample and photographic documentation are discussed in Section 2.4 of the FSAP. The discussion includes information concerning sample identification, chain-of-custody, and field records.

3.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Appropriate sample handling and custody helps to ensure the quality and accuracy of the analytical results. Sampling personnel will be responsible for recording the appropriate information on the sample containers, in field logbooks, and on the corresponding chain-of-custody forms. The following subsections of this QAPP describe the sample handling and custody procedures.

3.3.1 Sample Handling

The appropriate sample containers and preservatives will be assembled for the sample to be collected. Prior to sampling, a self-adhesive label will be affixed to each sample bottle. The label will be completed using waterproof ink immediately prior to sample collection and will contain the following information:

- Client – Job Name/Project Number,
- Sample identification,
- Date and time collected,
- Sampler's signature or initials
- Preservatives added, and
- Analysis to be performed.

The following information will also be recorded in a bound field log book:

- sample identification,
- date and time of collection,
- personnel present,
- type of sample,
- analysis required,
- sample location and depth (if applicable),
- containers filled, and
- preservatives used.

3.3.2 Sample Custody

Chain-of-custody forms will accompany samples containers to document the transfer of possession of the originating laboratory, through field collection, and to the laboratory receiving the samples for analysis. A sample container is considered to be in the possession of field personnel when:

- it is in the persons actual possession;
- it is in the persons view, after being in their possession; or,
- it was secured by the person in such a way as to prevent unauthorized access.

Each time possession of samples change, the appropriate section of the chain-of-custody form will be completed. The person relinquishing custody will sign and record the date and time custody was relinquished. The person receiving custody will also sign and record the date and time custody was received.

Sampling personnel will complete and verify the chain-of-custody forms. A copy of the chain-of-custody form will be retained and placed in the project file. The original form will accompany the samples to the laboratory. Prior to shipping, the shipping container will be secured with the competed chain-of-custody form inside. The shipping container will be closed and secured with appropriate shipping tape. A custody seal will be affixed across the opening of the container. The seal will be labeled with the date and signature of the sampler.

When received by the laboratory, the samples will be managed according the laboratory's QA procedures (Attachment 1). Typically, the receiving laboratory will perform the following:

- Inspect the shipping containers and note the physical condition and confirm that custody seals are intact.
- Inspect each sample container for damage or leaks and inspect the label.
- Note the presence or absence of sample container custody seals.
- Reconcile the samples received against the chain-of-custody record including the sample identification, type of sample, volume, preservative, date collected, time collected, and analysis required.
- Log the samples in the laboratory logbook, prepare a sample receipt report, assign a laboratory identification number, and store the sample in a secure sample storage area.
- Notify the sampler of any problems with the samples received (e.g., broken bottles, missing seals, conflicts between chain of custody information and sample label information).

Conflicts between the sample label and the chain of custody will be resolved before the sample is assigned for analysis. The sampler will be informed of any such discrepancies and their resolution. The conflict and its resolution will also be documented in the laboratory report.

3.4 ANALYTICAL METHODS REQUIREMENTS

There are five analytical levels recognized by the Superfund Program (US EPA, 1987). Table 2 presents a summary of these levels. These levels are useful in describing the level of analysis that will be performed. For the Lake Conestee follow-up investigation, Levels I and III data will be prepared.

Samples collected during the investigation will be analyzed for the parameters described for each media in the Work Plan and FSAP. Laboratory procedures consistent with the DQO Level III, such as methods described in Test Methods for Evaluating Solid Waste-Physical/Chemical Methods, SW-846, 3rd Edition (SW-846 US EPA, 1992), will be principally used. The proposed SW-846 analytical methods are included in Table 1.

3.5 QUALITY CONTROL REQUIREMENTS

Quality control activities will be performed by collecting QC samples and by various laboratory QC activities. Samples that will be used for QC purposes include trip blanks, field blanks, duplicate samples, split samples, and matrix spike samples. Each of these sample types is discussed in the following paragraphs. The Accutest Laboratories Southeast, Inc. laboratory will analyze samples collected for off-site analysis during the Lake Conestee follow-up investigation.

A trip blank is a sample that travels with the sample containers from the laboratory, and remains with the samples during sample collection and shipment back to the laboratory. The trip blank is prepared by filling a sample container with organic-free water and any required preservative. Trip blanks are routinely used for volatile organics analyses. Trip blanks will be used at a rate of one per shipping container per sample matrix.

A field blank is collected at the same time other samples are being collected. A sample container is filled with organic-free water and the appropriate preservative. The water used to fill the container has been handled the same as the other samples; that is, it is poured over or through any sampling equipment that is used to collect samples after decontamination. Field blanks measure the effectiveness of decontamination procedures and measure the quantity of analytes introduced through the sampling procedures. Field blanks are used for both organic and inorganic analysis.

Field duplicate samples are used to measure the precision of the sampling and analysis. The sample is collected by dividing a thoroughly mixed sample (except in the case of volatile organic analysis) into two parts. The two parts are then submitted as separate samples to the laboratory for analysis. The relative percent difference between the two sample results can be calculated. The field duplicate sample collection plan for this assessment is presented in Table 1. Split samples are similar to duplicate samples. The sample is collected in the same manner, but the analysis is performed by two separate laboratories. The split sample provides a measure of accuracy in the sample analysis. Split samples will be collected at the request of the regulatory agencies.

Matrix spike samples are used to quantify the effect of the sample matrix on the analysis methodology. The sample is collected similar to the duplicate sample, but a known amount of analyte is added to the sample by the laboratory.

During the data validation process described in Section 2.6, the results of the QC samples will be used to evaluate the PARCC parameters. Appropriate actions will be taken during the validation process according to the methods contained in SW-846 (US EPA, 1992).

3.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Instruments and equipment used in the field during the investigation will be frequently tested and inspected to confirm proper operation. Spare parts will be maintained to prevent delays in equipment repair. Backup instruments will be accessible should primary equipment fail. The off-site laboratory will be responsible for testing, inspecting, and maintaining their equipment.

Field equipment will be maintained and calibrated according to the frequency and procedures contained in the manufacturer's requirements. Field calibration and maintenance will be documented in the field logbook.

3.7 INSTRUMENT CALIBRATION AND FREQUENCY

Instrument calibration is an important part of an effective QA program. All instruments related to data collection that are capable of adjustment will be properly calibrated at the appropriate frequency. Calibration records will also be maintained as evidence of properly operating instruments. Laboratory equipment will be calibrated according to the laboratory's QA plan (Attachment 1). Field equipment will be calibrated according to the following schedule:

- pH meter daily (start, end)
- Conductivity Meter daily (start, end)
- Thermometer semi-annually

3.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The Project Manager is responsible for inspecting the supplies and consumables to be used on this project. The supplies and consumables include the following:

- Sampling equipment – sample containers, shipping containers, and organic-free water.
- Decontamination fluids – detergent, potable water, deionized water, isopropyl alcohol.
- Personal protective equipment – gloves and coveralls.

Shipping containers received from the laboratory will be inspected and inventoried to confirm that all requested items have been received and are in good condition. The shipping container will be inspected for signs of tampering or mishandling. Replacements will be requested from the laboratory as necessary.

Detergent for decontamination will be purchased for the project. When received, it will be inspected to confirm it is appropriate for the intended use. The potable water supply will be confirmed to be secure and easily accessible. Deionized water and laboratory pure water will be obtained from the analytical laboratory. The laboratory will supply the water in sealed containers with documentation of the quality of the water (i.e., deionized or organic-free). The water will not be used unless it is received with the seals intact and the appropriate documentation.

The pesticide-free isopropanol for decontamination will be purchased for the project. The containers will be inspected for damage and for intact seals. It the containers are damaged or the seals not intact, the isopropanol will be rejected.

New personal protective equipment will be used for the project. Each item will be visually inspected prior to use to ensure that it is undamaged and not contaminated. If any equipment is damaged or contaminated, it will be rejected.

4.0 ASSESSMENT AND OVERSIGHT

4.1 ASSESSMENT AND RESPONSE ACTIONS

Assessments will be performed throughout the project to ensure the quality of the data collected and the reports generated. Corrective action will be taken to prevent recurrence of any non-conformances.

The off-site laboratory will be responsible for performing internal audits and assessments to ensure their data quality. Any deficiencies identified by the assessments will be addressed by the laboratory's corrective action program (Attachment 1).

Field personnel are responsible for assessing the operation of the equipment they are using through calibration and observation of performance. Corrective actions will be instituted whenever conditions are identified that may negatively affect the quality of the information being acquired. All staff members are responsible for reporting any project activity or product discovered in nonconformance with established plans and procedures and to initiate the corrective action process.

The procedure for reporting nonconformance includes the following three steps:

- The discoverer of the nonconformance will immediately notify the on-site coordinator who will in turn notify the task leader and the QA officer.
- The task leader will then investigate the extent of the problem and recommend corrective action.
- Any data that has been adversely affected by the nonconformance will be identified and documented in the project file. If necessary, the data will be rejected.

System audits will be performed throughout the project. The on-site coordinator or the remedial investigation task leader is responsible for supervising and checking that each batch of samples is collected. The samples should be handled in accordance with the approved methods describe in the project documents.

Audits will be performed on the following activities:

- Field Performance audits – At least one day per week, the Project Manager will personally observe field personnel collecting samples, packing samples for shipment, decontaminating equipment, etc. The Project Manager will personally oversee subcontractors.

- System audits – The Project Manager will personally review all project documentation at least weekly. Before a report or technical memo is issued, the Project Manager, QA officer, or an assigned qualified QA reviewer will review the item.
- QA Program audits - The project coordinator will regularly review the QA program with the QA Officer to ensure that the quality assurance program is being implemented.

Corrective actions will be taken based on deficiencies identified during an audit or at any other time. The specific corrective actions will differ based on the nature of the deficiency. However, the general corrective action program will be implemented as follows. The recommended corrective action will be documented in a memorandum along with the time for implementation. The QA Officer will follow up to ensure that the recommended corrective action has been implemented. The results of the follow-up assessment will be documented in a memorandum.

4.2 REPORTS TO MANAGEMENT

The Project Manager will review field notes, sampling records, and chain-of-custody forms and will provide a summary of any significant QA problems and recommended solutions.

Laboratory data will be checked before release according to the laboratory's QA/QC program (Attachment 1). Once the data are received from the laboratory, a member of the project team will also review the data. Information concerning the quality of the data will be included in the Assessment Report. The Assessment Report will include:

- A copy of the laboratory report.
- A summary of the data quality.
- An assessment of the PARCC parameters.
- A discussion of any quality control problems and corrective actions undertaken to resolve problems.

5.0 DATA VALIDATION AND USABILITY

5.1 DATA REVIEW, VALDATION, AND VERIFICATION REQUIREMENTS

Field and laboratory data will be reviewed by a QC Reviewer to evaluate the PARCC parameters. The criteria for accepting or rejecting data are those described in Section 3.5 of this QAPP. The general review process is listed in Section 2.6 of this QAPP.

5.2 VALIDATION AND VERIFICATION METHODS

The validation process will be conducted according to the appropriate sections of SW-846. The review will be appropriately documented. The general review process is listed in Section 2.6 of this QAPP. Data associated with QC parameters that are outside of acceptable limits will be flagged as such and an explanation of the deviation will be included in the report. The QA Officer is responsible for ensuring that any corrective actions required by field personnel or the laboratory are implemented.

5.3 RECONCILIATION WITH USER REQUIREMENTS

The project QA/QC Reviewer will assign the appropriate data qualifiers to any analysis results that may not meet the PARCC parameters. Any data that are rejected based on the PARCC review will be discussed with the Zapata/Pinnacle Project Manager who will decide whether re-sampling or analysis is required in order to meet the DQO of the project. The Assessment Report will include information concerning the data quality.

TABLE 1

Sampling and Analytical Requirements

Lake Conestee Brownfields

TYPE OF SAMPLE	PARAMETER	Analytical Methods	NO. of Field Samples	LABORATORY QA SAMPLES: NO. of Dups/ Splits	LABORATORY QA SAMPLES: NO. of Smplr Rnsts	LABORATORY QA SAMPLES: NO. of Trip Blanks[1]	Total Samples	Holding Times	Preservation	Sample Cntnrs
FISH TISSUE	PCBs	EPA 8082	10	1	0	0	11		Cool to 4°C	
	Organo-chlorine Pesticides	EPA 8081A	10	1	0	0	11		Cool to 4°C	
	TAL Metals	EPA 6010B/7000A	10	1	0	0	11		Cool to 4°C	
IDW WATER	VOCs	EPA 8260B	1	0	0	0	1	14 Days	Cool to 4°C; HCL or H_2SO_4 to pH<2[2]	3 - 40 mL GSV[3]
	TAL Metals	EPA 6010B/7000A	1	0	0	0	1	6 Months except Hg; 28 Days for Hg	Cool to 4°C; HNO_3 to pH<2	1 L HDPE
	PCBs	EPA 8082	1	0	0	0	1	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	Organo-chlorine Pesticides	EPA 8081A	1	0	0	0	1	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	SVOCs	EPA 8270C	1	0	0	0	1	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
"UNSAMPLED AREAS" SEDIMENT SAMPLES	TAL Metals	EPA 6010B/7000A	25	2	2	0	29	6 Months except Hg; 28 Days for Hg	Cool to 4°C	250 mL CWM
	VOCs	EPA 8260B	5	1	1	1	8		Cool to 4°C	
	PAHs	EPA 8270C	20	2	2	0	24	14d/40d[4]	Cool to 4°C	250 mL CWM
	PCBs	EPA 8082	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	Organo-chlorine Pesticides	EPA 8081A	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	SVOCs	EPA 8270C	5	1	1	0	7	14d/40d[4]	Cool to 4°C	250 mL CWM

TABLE 1

Sampling and Analytical Requirements

Lake Conestee Brownfields

				LABORATORY QA SAMPLES						
TYPE OF SAMPLE	PARAMETER	Analytical Methods	NO. of Field Samples	NO. of Dups/ Splits	NO. of Smplr Rnsts	NO. of Trip Blanks[1]	Total A-E Smpls	Holding Times	Preservation	Sample Cntnrs
"NEW EXPOSURE AREAS" SURFACE WATER SAMPLES	TAL Metals	EPA 6010B/7000A	10	1	1	0	12	6 Months except Hg; 28 Days for Hg	Cool to 4°C; HNO3 to pH<2	1 L HDPE
	PAHs	EPA 8270C	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	Organo-chlorine Pesticides	EPA 8081A	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	PCBs	EPA 8082	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
"NEW EXPOSURE AREAS" SEDIMENT SAMPLES	TAL Metals	EPA 6010B/7000A	25	2	2	0	29	6 Months except Hg; 28 Days for Hg	Cool to 4°C	250 mL CWM
	PAHs	EPA 8270C	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	Organo-chlorine Pesticides	EPA 8081A	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	PCBs	EPA 8082	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM

TABLE 1

Sampling and Analytical Requirements

Lake Conestee Brownfields

				LABORATORY QA SAMPLES						
TYPE OF SAMPLE	PARAMETER	Analytical Methods	NO. of Field Samples	NO. of Dups/ Splits	NO. of Smplr Rnsts	NO. of Trip Blanks[1]	Total A-E Smpls	Holding Times	Preservation	Sample Cntnrs
"BACKGROUND" SOIL AND SEDIMENT SAMPLES	TAL Metals	EPA 6010B/7000A	6	1	1	0	8	6 Months except Hg; 28 Days for Hg	Cool to 4°C	250 mL CWM
"UNSAMPLED AREAS" SURFACE WATER SAMPLES	TAL Metals	EPA 6010B/7000A	10	1	1	0	12	6 Months except Hg; 28 Days for Hg	Cool to 4°C; HNO_3 to pH<2	1 L HDPE
	VOCS	EPA 8260B	2	1	1	1	5	14 Days	Cool to 4°C; HCL or H_2SO_4 to pH<2[2]	3 - 40 mL GSV[3]
	PAHs	EPA 8270C	8	1	1	0	10	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	Organo-chlorine Pesticides	EPA 8081A	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	PCBs	EPA 8082	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	SVOCs	EPA 8270C	2	1	1	0	4	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG

[1] Estimated quantity. One trip blank per cooler containing VOC samples.
[2] Add 0.008% $Na_2S_2O_3$ if residual Cl present
[3] No headspace.
[4] 14 days until extraction/analyzed within 40 days after extraction
[5] 7 days until extraction/analyzed within 40 days after extraction.

HDPE = high density polyethylene bottle
AG = Amber Glass bottle with Teflon-lined cap
GSV = glass VOA vial with Teflon septa cap
CWM = clear wide-mouthed glass jar with Teflon-lined cap

Table 2
Analytical Levels for Superfund RI/FS

Analytical Level	Type of Analysis	Examples
Level I	Field Screening	Organic vapor analyzer Methane monitor pH meter Dissolved oxygen meter Explosive gas meter
Level II	Field Analytical	Portable or mobile instruments Field gas chromatograph Chemical or biochemical test kits
Level III	Non CLP Laboratory Analysis	SW-846 Methodology Standard Methods for Wastewater Analysis Air Sampling and Analysis
Level IV	CLP Laboratory Analysis	Follows CLP methodology
Level V	Non-conventional testing	Modifications of existing methods Experimental methodology

Figure 1
Zapata/Pinnacle Project Team
Follow-Up Investigation Activities
Lake Conestee, Greenville County, South Carolina

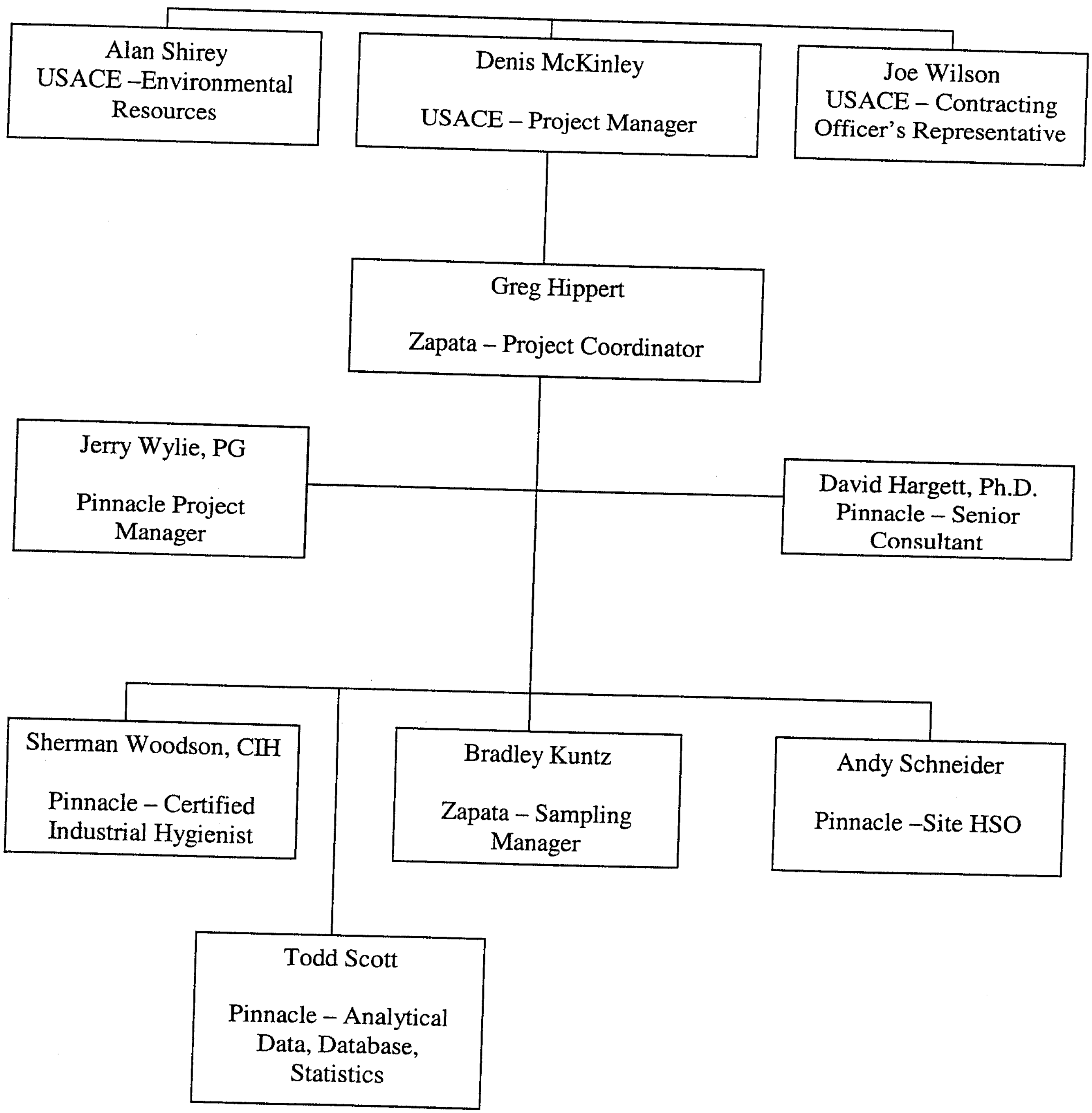
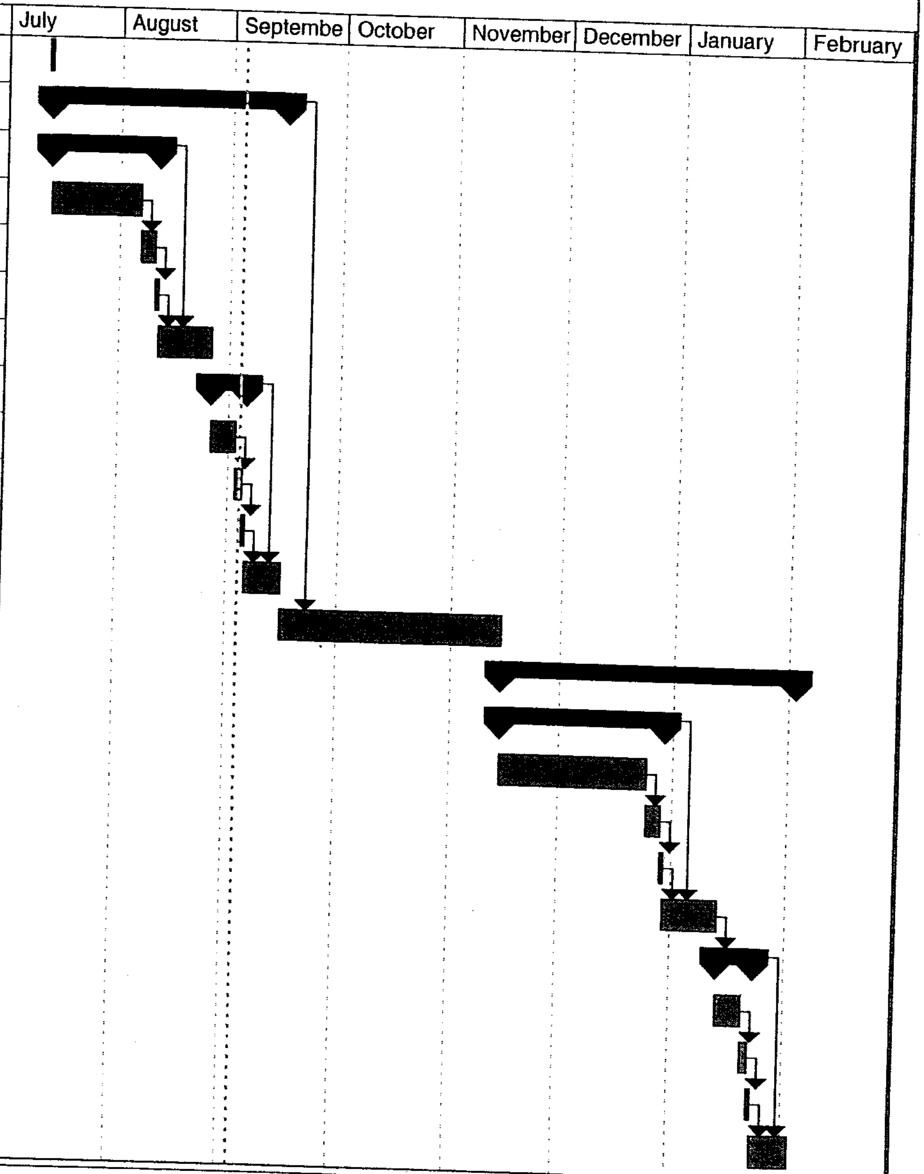


Figure 2
Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee, Greenville, South Carolina

ID	Task Name	Duration	Start	Finish
1	**Notice to Proceed**	**1 day**	**Fri 7/12/02**	**Fri 7/12/02**
2	**Workplan Addendum**	**65 days**	**Sat 7/13/02**	**Sun 9/15/02**
3	**Draft Workplan Addendum**	**30 days**	**Sat 7/13/02**	**Sun 8/11/02**
4	Develop Draft Workplan Addendum	25 days	Sat 7/13/02	Tue 8/6/02
5	Internal Review & Packaging	4 days	Wed 8/7/02	Sat 8/10/02
6	Submit Draft Workplan Addendum	1 day	Sun 8/11/02	Sun 8/11/02
7	Review Draft Workplan Addendum	15 days	Mon 8/12/02	Mon 8/26/02
8	**Final Workplan Addendum**	**10 days**	**Tue 8/27/02**	**Thu 9/5/02**
9	Develop Final Workplan Addendum	7 days	Tue 8/27/02	Mon 9/2/02
10	Internal Review & Packaging	2 days	Tue 9/3/02	Wed 9/4/02
11	Submit Final Workplan Addendum	1 day	Thu 9/5/02	Thu 9/5/02
12	Approve Final Workplan Addendum	10 days	Fri 9/6/02	Sun 9/15/02
13	**Complete Site Assessment (Field Work)**	**60 days**	**Mon 9/16/02**	**Thu 11/14/02**
14	**Site Assessment Report**	**80 days**	**Fri 11/15/02**	**Sun 2/2/03**
15	**Submit Draft Assessment Report**	**45 days**	**Fri 11/15/02**	**Sun 12/29/02**
16	Develop Draft Assessment Report	40 days	Fri 11/15/02	Tue 12/24/02
17	Internal Review & Packaging	4 days	Wed 12/25/02	Sat 12/28/02
18	Submit Draft Assessment Report	1 day	Sun 12/29/02	Sun 12/29/02
19	Review Draft Assessment Report	15 days	Mon 12/30/02	Mon 1/13/03
20	**Final Assessment Report**	**10 days**	**Tue 1/14/03**	**Thu 1/23/03**
21	Develop Final Assessment Report	7 days	Tue 1/14/03	Mon 1/20/03
22	Internal Review	2 days	Tue 1/21/03	Wed 1/22/03
23	Submit Final Assessment Report	1 day	Thu 1/23/03	Thu 1/23/03
24	Approve Final Assessment Report	10 days	Fri 1/24/03	Sun 2/2/03



Date: 6/25/02
DACA21-02-D-0006-0001

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

ATTACHMENT 1

SCDHEC CERTIFICATE OF LABORATORY CERTIFICATION AND ACCUTEST SOUTHEAST QUALITY SYSTEMS MANUAL

DHEC

PROMOTE PROTECT PROSPER

South Carolina Department of Health and Environmental Control

Environmental Laboratory Certification Program

In accordance with the provisions of Regulation 61 - 81, entitled "State Environmental Laboratory Certification Regulation,"

ACCUTEST LABORATORIES SE
4405 VINELAND RD STE C15
ORLANDO, FLORIDA 32811

is hereby certified to perform analyses as documented on the attached parameter list(s). This certification does not guarantee validity of data generated, but indicates the laboratory's adherence to prescribed methodology, quality control, records keeping, and reporting procedures. This certificate is the property of S.C. DHEC and must be surrendered upon demand. This certificate is non-transferable and is valid only for the parameters and methodology listed on the attached parameter list(s).

Laboratory Director: HARRY BEHZADI PHD
Certifying Authority: FL
Date of Issue: August 27, 2002
Date of Expiration: June 30, 2003
Certificate Number: 96038001

Director
Office of Environmental Laboratory Certification

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL
ENVIRONMENTAL LABORATORY CERTIFICATION PROGRAM

ACCUTEST LABORATORIES SE (Laboratory ID 96038)
Laboratory Director: HARRY BEHZADI PHD
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CLEAN WATER ACT

INORGANIC - DEMAND

BIOCHEMICAL OXYGEN DEMAND(BOD)	EPA 405.1
CHEMICAL OXYGEN DEMAND (COD)	EPA 410.1
DISSOLVED OXYGEN	EPA 360.1

INORGANIC - MINERAL

ALKALINITY	EPA 310.1
FLUORIDE	EPA 300.0
HYDROGEN-ION CONC. (PH)	EPA 150.1
SPECIFIC CONDUCTANCE	EPA 120.1

INORGANIC - MISCELLANEOUS

BROMIDE	EPA 300.0
COLOR - VISUAL	EPA 110.2
OIL & GREASE	EPA 413.1
PHENOLICS, TOTAL RECOVERABLE	EPA 420.1
SULFIDE	EPA 376.1
SURFACTANTS (MBAS)	EPA 425.1

INORGANIC - NUTRIENT

AMMONIA-NITROGEN	EPA 350.2
KJELDAHL-NITROGEN	EPA 351.3
NITRATE-NITROGEN	EPA 300.0
NITRITE-NITROGEN	EPA 354.1
PHOSPHORUS	EPA 365.3

INORGANIC - RESIDUE

RESIDUE, FILTERABLE (TDS)	EPA 160.1
RESIDUE, NONFILTERABLE (TSS)	EPA 160.2

SOLID & HAZARDOUS WASTES

INORGANIC - HAZARDOUS WASTE CHARACTERISTICS

IGNITABILITY (PENSKY MARTENS)	EPA 1010
REACTIVITY - CYANIDE	S.7.3. - SW846
REACTIVITY - SULFIDE	S.7.3. - SW846
TCLP - BOTTLE EXTRACTION	EPA 1311
TCLP - ZERO HEADSPACE	EPA 1311

INORGANIC - MINERAL

CHLORIDE	EPA 9056

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SOLID & HAZARDOUS WASTES

INORGANIC - MINERAL

FLUORIDE	EPA 9056
HYDROGEN-ION CONC. (PH)	EPA 9040B
HYDROGEN-ION CONC. (PH) (SOIL AND WASTE)	EPA 9045C
SULFATE	EPA 9056

INORGANIC - MISCELLANEOUS

BROMIDE	EPA 9056
CYANIDE	EPA 9014
CYANIDE AMEN. TO CHLORINATION	EPA 9010B
CYANIDE AMEN. TO CHLORINATION	EPA 9014
CYANIDE DISTILLATION	EPA 9010B
OIL & GREASE	EPA 9071A

INORGANIC - NUTRIENT

NITRATE-NITROGEN	EPA 9056
NITRITE-NITROGEN	EPA 9056
ORTHOPHOSPHATE	EPA 9056

INORGANIC - TRACE METAL

ALUMINUM	EPA 6010B
ANTIMONY	EPA 6010B
ARSENIC	EPA 6010B
BARIUM	EPA 6010B
BERYLLIUM	EPA 6010B
CADMIUM	EPA 6010B
CALCIUM	EPA 6010B
CHROMIUM	EPA 6010B
CHROMIUM, HEXAVALENT	EPA 7196A
COBALT	EPA 6010B
COPPER	EPA 6010B
IRON	EPA 6010B
LEAD	EPA 6010B
MAGNESIUM	EPA 6010B
MANGANESE	EPA 6010B
MERCURY	EPA 7470A
MERCURY	EPA 7471A
MOLYBDENUM	EPA 6010B
NICKEL	EPA 6010B
POTASSIUM	EPA 6010B
SELENIUM	EPA 6010B
SILVER	EPA 6010B
SODIUM	EPA 6010B
THALLIUM	EPA 6010B

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SOLID & HAZARDOUS WASTES

INORGANIC - TRACE METAL

TIN	EPA 6010B	
VANADIUM	EPA 6010B	
ZINC	EPA 6010B	

PCBS AND PESTICIDES

ORGANOCHLORINE PESTICIDES BY GC: CAP.COL.	EPA 8081A	EPA 3510C
ORGANOCHLORINE PESTICIDES BY GC: CAP.COL.	EPA 8081A	EPA 3550B
ORGANOCHLORINE PESTICIDES BY GC: CAP.COL.	EPA 8081A	EPA 3580A
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3510C
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3550B
POLYCHLORINATED BIPHENYLS BY GC	EPA 8082	EPA 3580A

SEMI-VOLATILES

SEMIVOLATILE ORGANICS BY GC/MS:CAP. COL.	EPA 8270C	EPA 3510C
SEMIVOLATILE ORGANICS BY GC/MS:CAP. COL.	EPA 8270C	EPA 3580A
SEMIVOLATILE ORGANICS BY GC/MS:CAP. COL.	EPA 8270C	EPA 3550B
TPH - DIESEL RANGE ORGANICS (DRO)	EPA 8015B (DRO)	EPA 3510C
TPH - DIESEL RANGE ORGANICS (DRO)	EPA 8015B (DRO)	EPA 3550B

VOLATILES (VOCS)

TPH - GASOLINE RANGE ORGANICS (GRO)	EPA 8015B (GRO)	EPA 5030B
VOLATILE ORGANICS BY GC/MS: CAPILLARY COL.	EPA 8260B	EPA 3585
VOLATILE ORGANICS BY GC/MS: CAPILLARY COL.	EPA 8260B	EPA 5030B
VOLATILE ORGANICS BY GC/MS: CAPILLARY COL.	EPA 8260B	EPA 5035

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SOLID & HAZARDOUS WASTES

---------PCBS AND PESTICIDES--------

EPA 8081A
EPA 3510C

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DELTA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE
METHOXYCHLOR
TOXAPHENE

EPA 8081A
EPA 3550B

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE
METHOXYCHLOR
TOXAPHENE

EPA 8081A
EPA 3580A

4,4'-DDD
4,4'-DDE
4,4'-DDT
ALDRIN
ALPHA-BHC
ALPHA-CHLORDANE
BETA-BHC
DIELDRIN
ENDOSULFAN I
ENDOSULFAN II
ENDOSULFAN SULFATE
ENDRIN
ENDRIN ALDEHYDE
ENDRIN KETONE
GAMMA-BHC (LINDANE)
GAMMA-CHLORDANE
HEPTACHLOR
HEPTACHLOR EPOXIDE
METHOXYCHLOR
TOXAPHENE

EPA 8082
EPA 3510C

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

EPA 8082
EPA 3550B

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

EPA 8082
EPA 3580A

PCB-1016 (AROCLOR-1016)
PCB-1221 (AROCLOR-1221)
PCB-1232 (AROCLOR-1232)
PCB-1242 (AROCLOR-1242)
PCB-1248 (AROCLOR-1248)
PCB-1254 (AROCLOR-1254)
PCB-1260 (AROCLOR-1260)

-----------SEMI-VOLATILES-----------

EPA 8270C
EPA 3510C

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,2-DIPHENYLHYDRAZINE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE
2,6-DINITROTOLUENE
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIMETHYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE

EPA 8270C
EPA 3550B

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,2-DIPHENYLHYDRAZINE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE
2,6-DINITROTOLUENE
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE

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SOLID & HAZARDOUS WASTES

------------SEMI-VOLATILES------------

EPA 8270C
EPA 3550B

2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZOIC ACID
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE
BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIMETHYLAMINE
N-NITROSODIPHENYLAMINE

EPA 8270C
EPA 3550B

NAPHTHALENE
NITROBENZENE
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE

EPA 8270C
EPA 3580A

1,2,4-TRICHLOROBENZENE
1,2-DICHLOROBENZENE
1,2-DIPHENYLHYDRAZINE
1,3-DICHLOROBENZENE
1,4-DICHLOROBENZENE
2,4,5-TRICHLOROPHENOL
2,4,6-TRICHLOROPHENOL
2,4-DICHLOROPHENOL
2,4-DIMETHYLPHENOL
2,4-DINITROPHENOL
2,4-DINITROTOLUENE
2,6-DINITROTOLUENE
2-CHLORONAPHTHALENE
2-CHLOROPHENOL
2-METHYLNAPHTHALENE
2-METHYLPHENOL
2-NITROANILINE
2-NITROPHENOL
3,3-DICHLOROBENZIDINE
3-NITROANILINE
4,6-DINITRO-2-METHYLPHENOL
4-BROMOPHENYLPHENYL ETHER
4-CHLORO-3-METHYLPHENOL
4-CHLOROANILINE
4-CHLOROPHENYL PHENYL ETHER
4-METHYLPHENOL
4-NITROANILINE
4-NITROPHENOL
ACENAPHTHENE
ACENAPHTHYLENE
ANTHRACENE
BENZO(A)ANTHRACENE
BENZO(A)PYRENE
BENZO(B)FLUORANTHENE
BENZO(G,H,I)PERYLENE
BENZO(K)FLUORANTHENE
BENZYL ALCOHOL
BIS(2-CHLOROETHOXY)METHANE

EPA 8270C
EPA 3580A

BIS(2-CHLOROETHYL)ETHER
BIS(2-CHLOROISOPROPYL)ETHER
BIS(2-ETHYLHEXYL)PHTHALATE
BUTYL BENZYL PHTHALATE
CHRYSENE
DI-N-BUTYL PHTHALATE
DI-N-OCTYL PHTHALATE
DIBENZO(A,H)ANTHRACENE
DIBENZOFURAN
DIETHYL PHTHALATE
DIMETHYL PHTHALATE
FLUORANTHENE
FLUORENE
HEXACHLOROBENZENE
HEXACHLOROBUTADIENE
HEXACHLOROCYCLOPENTADIENE
HEXACHLOROETHANE
INDENO(1,2,3-CD)PYRENE
ISOPHORONE
N-NITROSODI-N-PROPYLAMINE
N-NITROSODIMETHYLAMINE
N-NITROSODIPHENYLAMINE
NAPHTHALENE
NITROBENZENE
PENTACHLOROPHENOL
PHENANTHRENE
PHENOL
PYRENE

------------VOLATILES (VOCS)------------

EPA 8015B (GRO)
EPA 5030B

TPH - LOW BOIL. PT. (GAS.)

EPA 8260B
EPA 3585

1,1,1,2-TETRACHLOROETHANE
1,1,1-TRICHLOROETHANE
1,1,2,2-TETRACHLOROETHANE
1,1,2-TRICHLOROETHANE
1,1-DICHLOROETHANE
1,1-DICHLOROETHENE
1,1-DICHLOROPROPENE
1,2,3-TRICHLOROBENZENE
1,2,3-TRICHLOROPROPANE

EPA 8260B
EPA 3585

1,2,4-TRICHLOROBENZENE
1,2,4-TRIMETHYLBENZENE
1,2-DIBROMO-3-CHLOROPROPANE(DBCP)
1,2-DIBROMOETHANE (EDB)
1,2-DICHLOROBENZENE
1,2-DICHLOROETHANE
1,2-DICHLOROPROPANE
1,3,5-TRIMETHYLBENZENE
1,3-DICHLOROBENZENE
1,3-DICHLOROPROPANE
1,4-DICHLOROBENZENE
2,2-DICHLOROPROPANE
2-CHLOROETHYLVINYL ETHER
2-CHLOROTOLUENE
4-CHLOROTOLUENE
4-METHYL-2-PENTANONE
BENZENE
BROMOBENZENE
BROMOCHLOROMETHANE
BROMODICHLOROMETHANE
BROMOFORM
BROMOMETHANE
CARBON TETRACHLORIDE
CHLOROBENZENE
CHLOROETHANE
CHLOROFORM
CHLOROMETHANE
CIS-1,2-DICHLOROETHENE
CIS-1,3-DICHLOROPROPENE
DIBROMOCHLOROMETHANE
DIBROMOMETHANE
ETHYLBENZENE
HEXACHLOROBUTADIENE
ISOPROPYLBENZENE
METHYL TERT BUTYL ETHER (MTBE)
METHYLENE CHLORIDE
N-BUTYLBENZENE
N-PROPYLBENZENE
NAPHTHALENE
P-ISOPROPYLTOLUENE
SEC-BUTYLBENZENE
STYRENE
TERT-BUTYLBENZENE
TETRACHLOROETHENE
TOLUENE
TRANS-1,2-DICHLOROETHENE
TRANS-1,3-DICHLOROPROPENE
TRICHLOROETHENE

ACCUTEST

Quality Systems Manual

July 2002

Document Control Number: ______

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Introduction

The Accutest Laboratories Southeast, Inc. (Accutest SE) Quality Assurance Program, detailed in this plan, has been designed to meet the quality program requirements of the National Environmental Laboratories Accreditation Conference (NELAC) and ISO Guide 25. The plan establishes the framework for documenting the requirements of the quality processes regularly practiced by the Laboratory. The Quality Assurance Officer is responsible for changes to the Quality Assurance Program, which are appended to the LQSM as they occur. The plan is reviewed annually for compliance purposes by the Laboratory Director and Technical Director and edited if necessary. Changes that are incorporated into the plan are summarized in the plan introduction. Changes to the plan are communicated to the general staff in a meeting conducted by the Quality Assurance Officer following the plan's approval.

The Accutest SE plan is supported by standard operating procedures (SOPs), which provide specific operational instructions on the execution of each quality element and assure that compliance with the requirements of the plan are achieved. Accutest SE employees are responsible for knowing the requirements of the SOPs and applying them in the daily execution of their duties. These documents are updated as changes occur and the staff is trained to apply the changes.

At Accutest, we believe that satisfying client requirements and providing a product that meets or exceeds the standards of the industry is the key to a good business relationship. However, client satisfaction cannot be guaranteed unless there is a system that assures the product consistently meets its design requirements and is adequately documented to assure that all procedural steps are executed and are traceable.

This plan has been designed to assure that this goal is consistently achieved and the Accutest product withstands the rigors of scrutiny that are routinely applied to analytical data and the processes that support its generation.

Summary of Changes
Accutest SE Quality System Manual – July 2002

Section	**Description**
Intro.	Changes criteria modified
1	Expiration date amended
2	Modified Accutest Laboratories organization chart
4	Clarified Employee Orientation and Training
5	Signature log location changed from HP to QA Office
6	Form revision requirement added
9	Corrosive waste substituted for Semi-solid waste
9	Bottle Order Procedure modified
10	Added instrumentation

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Appendices

1.0 QUALITY POLICY

1.1 *Accutest Mission*:

Accutest Laboratories provides analytical services to commercial and government clients in support of environmental monitoring and remedial activities as requested. The Laboratory's mission is dedicated to providing reliable data that satisfies clients requirements as explained in the following:

"Provide easy access, high quality, analytical support to commercial and government clients which meet or exceeds data quality objectives and provides them with the data needed to satisfy regulatory requirements and/or make confident decisions on the effectiveness of remedial activities."

1.2 *Policy Statement*:

The management and staff of Accutest Laboratories share the responsibility for product quality. Accordingly, Accutest's quality assurance program is designed to assure that all processes and procedures, which are components of environmental data production, meet established industry requirements, are adequately documented from a procedural and data traceability perspective, and are consistently executed by the staff. It also assures that analytical data of known quality, meeting the quality objectives of the analytical method in use and the data user's requirements, is consistently produced in the laboratory. This assurance enables the data user to make rational, confident, cost-effective decisions on the assessment and resolution of environmental issues.

The laboratory QA program also provides the management staff with data quality and operational feedback information. This enables them to determine if the laboratory is achieving the established quality and operational standards, which are dictated by the client or established by regulation. The information provided to management, through the QA program, is used to assess operational performance from a quality perspective and to perform corrective action as necessary.

Harry Behzadi, Ph.D. Laboratory Director	Norman Farmer Technical Director	Svetlana Izosimova, Ph.D. Quality Assurance Officer

Effective Date: July 18, 2002 Expiration Date: December 31, 2002

2.0 ORGANIZATION

2.1 ***Organizational Entity***. Accutest Laboratories is a privately held, independent testing laboratory founded in 1956 and registered as a New Jersey Corporation. The laboratory is located in Dayton, New Jersey where it has conducted business since 1987. Satellite laboratories are maintained in Marlborough, Massachusetts; Orlando, Florida and Houston, Texas.

2.2 ***Management Responsibilities***

Requirement: Each laboratory facility will have an established chain of command. The duties and responsibilities of the management staff are linked to the President/CEO of Accutest Laboratories who establishes the agenda for all company activities.

President/CEO. Primarily responsible for all operations and business activities. Delegates authority to laboratory directors, general managers, and quality assurance director to conduct day-to-day operations and execute quality assurance duties. Each of the three operational entities (New Jersey, Florida and Massachusetts) reports to the President/CEO.

Corporate Quality Assurance Director. Responsible for design, oversight, and facilitation of all quality assurance activities established by the Quality Program. Directly reports to the President/CEO.

Vice President Operations/Laboratory Director. There is Laboratory Director assigned to each of the operational entities: New Jersey, Massachusetts and Florida. Executes day-to-day responsibility for laboratory operations including technical aspects of production activities and associated logistical procedures. Directly reports to the President/CEO.

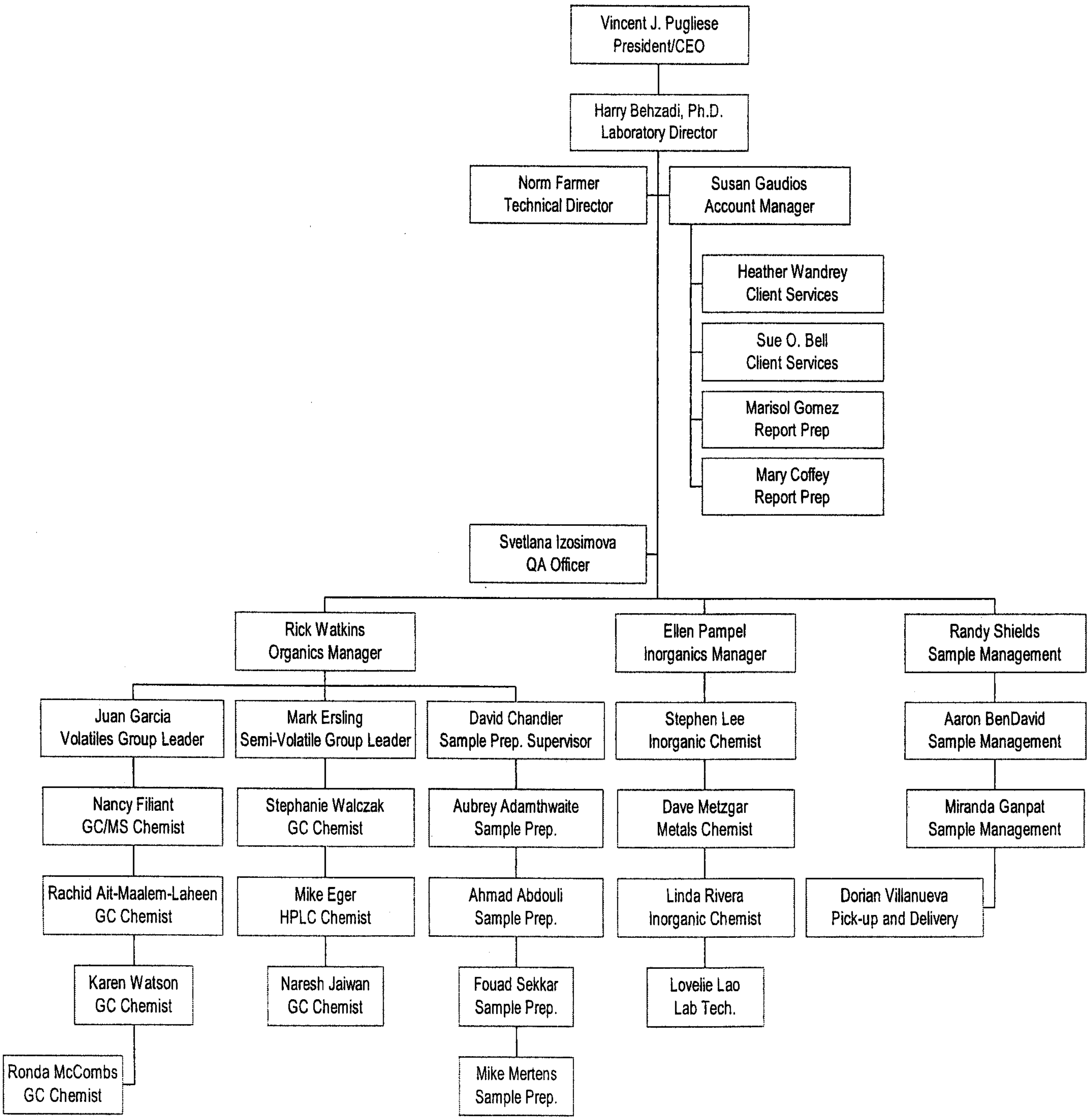
Quality Assurance Officer *(on location)*. Responsible for oversight, implementation and facilitation of all quality assurance activities established by the Quality Program. Directly reports to the Laboratory Director.

Technical Director. Responsible for oversight and implementation of technical aspects of production activities in the environmental testing laboratory. In the event of prolonged absence Quality Assurance Officer is designated a deputy Technical Director, and Technical Director is designated a deputy Quality Assurance Officer.

Department Managers. Executes day-to-day responsibility for specific laboratory areas including technical aspects of production activities and associated logistical procedures. Directly report to the Laboratory Director.

Section Supervisors. Executes day-to-day responsibility for specific laboratory units including technical aspects of production activities and associated logistical procedures. Directly report to the Department Manager.

Accutest Laboratories Southeast Organizational Chart



3.0 QUALITY RESPONSIBILITIES OF THE MANAGEMENT TEAM

3.1 ***Requirement***: Each member of the management team has a defined responsibility for the Quality Program. Program implementation and operation is designated as an operational management responsibility. Program design and implementation is designated as a Quality Assurance Responsibility.

President/CEO*:* Primary responsibility for all quality activities. Delegates program responsibility to the Quality Assurance Director. Serves as the primary alternate in the absence of the Quality Assurance Director. Has the ultimate responsibility for implementation of the Quality Program.

Vice President Operations/Laboratory Director. Responsible for implementing and operating the Quality Program in all laboratory areas. Responsible for the design and implementation of corrective action for defective processes. Has the authority to delegate Quality Program implementation responsibilities.

Corporate Quality Assurance Director. Responsible for design, implementation support, training, and monitoring of the quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if warranted by quality problems. Monitors implemented corrective actions for compliance.

Quality Assurance Officer *(on location)*. Responsible for implementation, support, and monitoring of the quality system. Training personnel in various aspects of quality system. Identifies product, process, or operational defects using statistical monitoring tools and processes audits for elimination via corrective action. Empowered with the authority to halt production if warranted by quality problems. Monitors implemented corrective actions for compliance.

Technical Director. Responsible for oversight and implementation of technical aspects of Quality System.

Department Managers. Responsible for applying the requirements of the Quality Program in their section and assuring subordinate supervisors and staff apply all program requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Section Supervisors. Responsible for applying the requirements of the Quality Program to their operation and assuring the staff applies all program requirements. Initiates, designs, documents, and implements corrective action for quality deficiencies.

Bench Analysts. Responsible for applying the requirements of the Quality Program to the analyses they perform, evaluating QC data and initiating corrective action for quality control deficiencies within their control. Implements global corrective action as directed by superiors.

3.2 ***Program Authority***:

Authority for program implementation originates with the President/CEO who bears ultimate responsibility for program design, implementation, and enforcement of requirements. This authority and responsibility is delegated to the Director of Quality Assurance who performs quality functions independently without the encumbrances or biases created by operational or production responsibilities to ensure an honest, independent assessment of quality issues.

3.3 ***Technical Ethics Policy***:

Accutest Laboratories provides analytical chemistry services on environmental matters to the regulated community. The data the company produces provides the foundation for determining the risk presented by a chemical pollutant to human health and the environment. The environmental laboratory business is dependent upon the accurate portrayal of environmental chemistry data. The process is reliant upon a high level of scientific and personal ethics.

It is essential to the Company that each employee understands the ethical and quality standards required to work in this industry. Accordingly, Accutest has adapted the following ethical code to which each employee is expected to adhere.

- To perform chemical and microbiological analysis using accepted scientific practices and principles.
- To be above personal compromise, inspiring confidence and honesty.
- To maintain professional integrity as an individual.
- To provide services in a confidential, honest, and forthright manner.
- To produce results that are accurate and defensible.
- To report information without any considerations of self-interest.
- To comply with all pertinent federal, state and local laws and regulations associated with assigned tasks and responsibilities.

Accutest's employees receive technical ethics training during new employee orientation. The training focuses on the reasons for technical ethic training, explains the impact of data fraud on human health and the environment, and illustrates the consequences of criminal fraud on businesses and individual careers. Accutest's ethics policy and code of ethics is reviewed and explained for each new employee. Each employee is required to sign an ethical conduct agreement, which verifies their understanding of Accutest's ethics policy and their ethical responsibilities. Update sessions are conducted annually.

4.0 JOB DESCRIPTIONS OF KEY STAFF

4.1 ***Requirement***: Descriptions of key positions within the organization must defined to ensure that clients and staff understand duties and the responsibilities of the management staff and the reporting relationships between positions.

President/Chief Executive Officer. Responsible for all laboratory operations and business activities. Establishes the company mission and objectives in response to business needs. Direct supervision of the Vice President of Operations, each laboratory director, client services, management information systems, and quality assurance.

Vice President, Operations/Laboratory Director. Reports to the company president. Establishes laboratory operations strategy. Direct supervision of organic chemistry, inorganic chemistry, field services, and sample management. Operational responsibility for Orlando, Florida and Marlborough, Massachusetts laboratories.

Director, Quality Assurance. Reports to the company president. Establishes the company quality agenda, develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities monitors the quality system and provides quality system feedback to management to be used for process improvement.

Director, Management Information Systems (MIS). Reports to the company president. Develops the MIS software and hardware agenda. Provides system strategies to compliment company objectives. Maintains all software and hardware used for data handling.

Manager Client Services. Reports to the company president. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

Quality Assurance Officer *(on location)*. Reports to the Laboratory Director. Develops quality procedures, provides assistance to operations on quality procedure implementation, coordinates all quality control activities, monitors the quality system, and provides quality system feedback to management to be used for process improvement. In the event of prolonged absence QAO also designated a Deputy Technical Director, unless otherwise specified by internal memo from Laboratory Director.

Manager Client Services *(on location)*. Reports to the Laboratory Director. Establishes and maintains communications between clients and the laboratory pertaining to client requirements which are related to sample analysis and data deliverables. Initiates client orders and supervises sample login operations.

Manager, Organics. Reports to the laboratory director. Directs the operations of the organics group, consisting of organics preparation and instrumental analysis. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality Program requirements. Maintains laboratory instrumentation in an operable condition.

Manager, Inorganics. Reports to the laboratory director. Directs the operations of the inorganics group, consisting of wet chemistry and the metals laboratories. Establishes daily work schedule. Supervises method implementation, application, and data production. Responsible for following Quality Program requirements. Maintains laboratory instrumentation in an operable condition.

Manager, Field Services. Reports to the laboratory director. Conducts field sampling and analysis of "analyze immediately" parameters in support of ongoing company projects. Responsible for proper collection, preservation, documentation and shipment of field samples. Maintains field sampling and field instrumentation required to perform primary responsibilities.

Manager, Sample Management. Reports to the laboratory director. Develops, maintains and executes all procedures required for receipt of samples, verification of preservation, and chain of custody documentation. Responsible for maintaining and documenting secure storage, delivery of samples to laboratory units on request, and disposal following completion of all analytical procedures. *Manager of Sample Management and Manager of Field Services are combined in Accutest-SE location.*

Supervisor, Wet Chemistry. Reports to the inorganics manager. Executes daily analysis schedule. Supervises the analysis of samples for wet chemistry parameters using valid, documented methodology. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. *Not applicable to Accutest-SE location (see Manager, Inorganics)*

Supervisor, Metals. Reports to the inorganics manager. Executes daily analysis schedule. Supervises the analysis of samples for metallic elements using valid, documented methodology. Documents all procedures and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements. *Not applicable to Accutest-SE location (see Manager, Inorganics)*

Supervisor, Organic Preparation. Reports to the organics manager. Executes the daily sample preparation schedule. Performs the extract of multi-media samples for organic constituents using valid, documented methodology. Prepares documentation for extracted samples. Assumes custody until transfer for analysis.

Technical Support Supervisor, Organics. Reports to the organic manager. Oversees all instrument maintenance and new equipment installation. Conducts method development and implementation tasks.

Assistant Manager, Organics. Reports to the organics manager. Expedites the analysis of samples and sample extracts. Executes daily analysis schedule. Supervises the analysis of samples for organic parameters using valid, documented methodology. Documents all data and data production activities. Maintains instrumentation in an operable condition. Reviews data for compliance to quality and methodological requirements.

In Accutest-SE location the positions of Assistant Manager, Organics and Technical Support Supervisor, Organics are substituted for Volatile Analysis Team Leader and Semivolatile Analysis Team Leader.

4.2 ***Employee Screening, Orientation, and Training***.

All potential laboratory employees are screened and interviewed by human resources and technical staff prior to their hire. The pre-screen process includes a review of their qualifications including education, training and work experience to verify that they have adequate skills to perform the tasks of the job.

Newly hired employees receive orientation training beginning the first day of employment by the Company. Orientation training consists of initial health and safety training and a detailed review of the chemical hygiene plan, technical ethics training and quality assurance program training (including Company's goals, objectives, mission, and vision).

All technical staff receives training to develop and demonstrate proficiency for the methods they perform. New analysts work under supervision until the supervisory staff is satisfied that a thorough understanding of the method is apparent. Organics/Inorganics analysts are required to demonstrate method proficiency through a precision and accuracy study. Data from the study is compared to method acceptance limits. If the data is unacceptable, additional training is required. The analyst must also demonstrate the ability to produce acceptable data through the analysis of an independently prepared proficiency sample.

Proficiency is demonstrated annually. Data from initial and continuing proficiency demonstration is archived in the individual's training folder. In the instance where analyte can not be spiked in the clean matrix, such as TSS or pH, the results of an external Performance Evaluation (PE) sample may be used to document analyst's proficiency.

Minimum training required for administrative staff consists of laboratory safety and ethical conduct.

4.3 ***Training Documentation***. The QA Officer prepares a training file for every new employee. All information related to qualifications, experience, external training courses, and education are placed into the file. Verification documentation for orientation, health & safety, quality assurance, and ethics training is also included in the file.

Additional training documentation is added to the file as it occurs. This includes data for initial and continuing demonstrations of proficiency, performance evaluation study data and notes and attendance lists from group training sessions.

5.0 SIGNATORY APPROVALS

Requirement: Procedures are required for establishing the traceability of data and documents. The procedure consists of a signature hierarchy, indicating levels of authorization for signature approvals of data and information within the organization. Signature authority is granted for approval of specific actions based on positional hierarchy within the organization and knowledge of the operation that requires signature approval. A log of signatures and initials of all employees is maintained for cross-referencing purposes.

5.1 *Signature Hierarchy*.

President/Chief Executive Officer. Authorization for contracts and binding agreements with outside parties. Approval of final reports, quality assurance policy, SOPs, project specific QAPs, data review and approval in lieu of technical managers.

Vice President, Operations/Laboratory Director. Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. Technical policy.

Technical Director (on location): Approval of final reports and quality assurance policy in the absence of the Laboratory Director. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. Technical policy review. Supplies In the event of prolonged absence Technical Director also designated a Deputy QAO, unless otherwise specified by internal memo from Laboratory Director.

Director, Quality Assurance. Approval of final reports and quality assurance policy in the absence of the President. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers.

Quality Assurance Officer (on location). Approval of final reports and quality assurance policy in the absence of the Laboratory Director. Approval of SOPs, project specific QAPs, data review and approval in lieu of technical managers. In the event of prolonged absence QAO also designated a Deputy Technical Director, unless otherwise specified by internal memo from Laboratory Director.

Director, Management Information Systems (MIS). Department specific supplies purchase. MIS policy.

Manager, Sample Management. Initiation of laboratory sample custody and acceptance of all samples. Approval of department policies and procedures. Department specific supplies purchase. Waste manifesting and disposal.

Manager Client Services. QAP and sampling and analysis plan approval. Project specific contracts, pricing, and price modification agreements. Approval and acceptance of incoming work, Client services policy.

Managers, Technical Departments. Methodology and department specific QAPs. Data review and approval, department specific supplies purchase. Technical approval of SOPs.

Assistant Managers: Technical Departments. Data review approval, purchasing of expendable supplies.

Supervisor, Field Services. Sampling plan design approval. Data review for field parameters. State form certification. Department policies and procedures. Department specific supplies purchase.

Supervisors, Technical Departments. Data review approval, purchasing of expendable supplies.

5.2 ***Signature Requirements***. All laboratory activities related to sample custody and generation or release of data must be approved using either initials or signatures. The individual, who applies his signature or initial to an activity or document, is authorized to do so within the limits assigned to them by their supervisor. All signatures and initials must be applied in a readable format that can be cross-referenced to the signatures and initials log if necessary.

5.3 ***Signature and Initials Log***. The QA Officer maintains a signature and initials log. New Employee signatures and initials are appended to the log on the first day of employment. Signature of individuals no longer employed by the company are retained, but annotated with their date of termination.

6.0 DOCUMENTATION

Requirement: Policies and procedures for the control, protection, and storage of any information related to the production of analytical data to assure its integrity and traceability must be established and practiced.

6.1 ***Form Generation & Control***. The quality assurance group approves all forms used as either stand-alone documents or in logbooks to ensure their traceability. The approved forms are maintained in a master book. Approved forms must display the date of current revision and initials of person who revised the form.

New forms must include the name Accutest Laboratories and appropriate spaces for signatures of approvals and dates. Further design specifications are the responsibility of the originating department.

Technical staff is required to complete all forms to the maximum extent possible. If information for a specific item is unavailable, the analyst is required to "Z" the information block. The staff is also required to "Z" the uncompleted portions of a logbook or logbook form if the day's analysis does not fill the entire page of the form.

6.2 ***Logbook Control***. All laboratory logbooks are controlled documents that are comprised of approved forms used to document specific processes. Logbook control is maintained by quality assurance.

New logs are numbered and issued to a specific individual who is assigned responsibility for the log. Old logs are returned to QA for entry into the document archive system where they are retained for five (5) years. Laboratory staff may hold a maximum of two consecutively dated logbooks of the same type in the laboratory including the most recently issued book to simplify review of recently completed analysis.

6.3 ***Controlled Documents.*** Key laboratory documents are designated for controlled document status to assure that identities of individuals receiving copies and the number of copies that have been distributed are known. Controlled status simplifies document updates and retrieval of outdated documents. Control is maintained through a document numbering procedure and document control logbook designating the individual receiving the controlled document. Document control is also maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory.

Quality Systems Manual (QSM). All QSMs are assigned a number prior to distribution. The number, date of distribution, and identity of the individual receiving the document are recorded in the document control logbook. The numbering system is restarted with each new revision of the QSM.

6.4 **Standard Operating Procedures (SOPs).** SOPs are maintained by pre-designating the numbers of official copies of documents that are placed into circulation within the laboratory. Official documents are copied to green paper and placed into the appropriate laboratory section as follows:

Sample Management: One green copy for the sample management file.
Organics Laboratories: Two green copies, One for the affected laboratory area, one for the organics laboratory file.
Inorganics Laboratories: Two green copies, One for the affected laboratory area, one for the inorganics laboratory file.

The original, signed copy of the SOP is maintained in the master SOP binder by the QA staff.

6.5 ***Quality Assurance Directory.*** All Quality Assurance documentation and quality control limit data is stored in a restricted QA directory on the network server. Information on this directory is backed-up daily.

This directory contains all current and archived quality system manuals, SOPs, control limits, MDL studies, precision and accuracy data, official forms, and metrics calibration information. The directory has been designated as read only. The QA staff and the laboratory director have write capability in this directory.

6.6 ***Software Change Documentation & Control.*** Changes to software are documented as text within the code of the program undergoing change. Documentation includes a description of the change, reason for change and the date the change was placed into effect. Documentation indicating the adequacy of the change is prepared following the evaluation by the user who requested the change.

6.7 ***Report and Data Archiving***. Accutest Laboratories maintains image file copies of original reports in archive for a period of five (5) years. After five years, the files are automatically discarded unless contractual arrangements exist which dictate different requirements. Client specific data retention practices are employed for government organizations such as the Department of Defense Agencies that require a retention period of ten (10) years.

Accutest archives the original report (organized by job number) and the organic and inorganic support data. Organic support data is archived according to instrument batch numbers. Wet chemistry support data is archived by test organized monthly. Metals support data is archived by batch number. Metals digestion data is archived by month.

The reports generation group electronically scans completed reports that are stored as individual data files by job number on CD-ROMS. CD-ROMS are transferred to an onsite fireproof safe for secure storage. Copies of these files remain active on the

LIMS server for easy review access. The CD-ROMS remain in secure storage for the remainder of the archive period.

Support data for inorganics accompanies completed reports that are sent to the report generation group. The report generation group segregates the data by analysis into individual files. The files are stored in a local filing cabinet for approximately two months. The files are then transferred to an archive box that is numbered according to the time frame the data was compiled. Filled boxes are transferred to the archive custodian who places these boxes into on site storage for a maximum of one year. After one year, the custodian transfers the archive boxes to secure off-site storage for the remainder of the archive period.

Organics support data is compiled by the analysts on a batch basis. Batch data is sent to the report generation group as it is completed. The report generation group stores the files in a local filing cabinet for approximately one month. The files are then transferred to archive boxes that are numbered according to batch number range. Filled boxes are transferred to the archive custodian who places these boxes into on site storage for one year. After one year, the custodian transfers the archive boxes to secure off-site storage for the remainder of the archive period.

Report generation maintains an active archive record, which includes a box identification number, the date it entered the controlled archive. A separate record is maintained for tracking retrieved and returned reports.

6.8 ***Training***. The company maintains a training record for all employees that documents that they have received instruction on administrative and technical tasks that are required for the job they perform. Training records for individuals employed by the company are retained for a period of five years following their termination of employment.

Training File Origination. The Quality Assurance Officer QAO initiates training files. Quality Assurance officer retains the responsibility for the maintenance and tracking of all training related documentation in the file. The file is begun on the first day of employment. Information required for the file includes a copy of the individual's most current resume, detailing work experience and a copy of any college diplomas or transcript(s). Information added on the first day includes documentation of health and safety training and a signed ethics agreement. These two constitute minimal necessary training for Project Management and Administrative staff.

6.9 ***Technical Training***. The supervisor of each new employee must submit a training plan outline to QAO detailing the areas of training the new employee will receive. The supervisor updates the outline, adding signatures and dates as training elements are completed. Supporting documentation, such as precision and accuracy studies, which demonstrate analyst capability for a specific test, are added as completed. When analyte can not be spiked, such as pH or TSS, external PE sample is purchased and analyzed. Certificates or diplomas for any off-site training are added to the file.

7.0 REFERENCE STANDARD TRACEABILITY

Requirement: Documented procedures, which establish traceability between any measured value and a national reference standard, must be in place in the laboratory. All metric measurements must be traceable to NIST reference weights or thermometers that are calibrated on a regular schedule. All chemicals used for calibration of a quantitative process must be traceable to an NIST reference that is documented by the vendor using a certificate of traceability. The laboratory maintains a documentation system that establishes the traceability links. The procedures for verifying and documenting traceability must be documented in standard operating procedures.

7.1 ***Traceability of Metric Measurements - Thermometers***. Accutest uses NIST thermometers to calibrate commercially purchased thermometers prior to their use in the laboratory. If necessary, thermometers are assigned correction factors that are determined during their calibration using an NIST thermometer as the standard. The correction factor is documented in a thermometer log and on a tag attached to the thermometer. The correction factor is applied to temperature measurements before recording the measurement in the temperature log. The NIST thermometer is verified by outside vendor on annual basis. Certificate(s) of calibration are maintained on file with QAO.

7.2 ***Traceability of Metric Measurements – Calibration Weights***. Accutest uses calibrated weights, which are traceable to NIST standard weights to calibrate all balances used in the laboratory. Balances must be calibrated to specific tolerances within the intended use range of the balance. Calibration checks are required on each day of use. If the tolerance criteria are not achieved, corrective action specified in the balance calibration SOP must be applied before the balance can be used for laboratory measurements. All weights are recalibrated by outside vendor on annual basis. Certificate(s) of calibration are maintained on file with QAO. Balances are inspected and maintained by professional service technicians. Certificate(s) of inspection are maintained with QAO.

7.3 ***Traceability of Chemical Standards***. All chemicals, with the exception of bulk dry chemicals and acids, purchased as reference standards for use in method calibration must establish traceability to NIST referenced material through a traceability certificate. Process links are established that enable a calibration standard solution to be traced to its NIST reference certificate.

7.4 ***Assignment Of Reagent and Standard Expiration Dates.*** Expiration date information for all purchased standards and reagents is provided with all prepared standard solutions and unstable reagents as a condition of purchase. Neat materials and inorganic reagents are not required to be purchased with expiration dates. Prepared solutions are labeled with the expiration date provided by the manufacturer. In-house prepared solutions are assigned expiration dates that are consistent with the method that employs their use unless documented experience indicates that an alternate date can be applied. If alternate expiration dates are employed, their use is documented in the method SOP. Expiration dates for prepared inorganic reagents, which have not exhibited instability are established at two years form the date of preparation for tracking purposes. All containers shall be labeled with the date of preparation and expiration date clearly indicated.

The earliest expiration date is always the limiting date for assigning expiration dates to prepared solutions. Expiration dates that are later than the expiration date of any derivative solution or material are prohibited.

7.5 ***Documentation of Traceability***. Traceability information is documented in individual logbooks designated for the measurement process in use. The quality assurance group maintains calibration documentation for metric references in separate logbooks.

Balance calibration verification is documented in logbooks that are assigned to each balance. The individual conducting the calibration is required to initial and date all calibration activities. Any defects that occur during calibration are also documented along with the corrective action applied and a demonstration of return to control.

Temperature control is documented in logbooks assigned to the equipment being monitored. A calibrated thermometer is assigned to each individual item. Measurements are recorded along with date and initials of the individual conducting the measurement on a daily or as used basis. Corrective action, if required, is also documented including the demonstration of return to control.

Initial traceability of chemical standards is documented via a vendor-supplied certificate (not available for bulk dry chemicals and acids) that includes lot number and expiration date information. Solutions prepared using the vendor supplied chemical standard are documented in logbooks assigned to specific analytical processes. The documentation includes links to the vendors lot number, an internal lot number, dates of preparation, and the preparer's initials.

8.0 TEST PROCEDURES, METHOD REFERENCES, AND REGULATORY PROGRAMS

Requirements: The laboratory must use client specified or regulatory agency approved methods for the analysis of environmental samples. The laboratory maintains a list of active methods, which specifies the type of analysis performed, and cross-references the methods to applicable environmental regulation. Routine procedures used by the laboratory for the execution of a method must be documented in a standard operating procedure. Method performance and sensitivity must be demonstrated annually where required. Defined procedures for the use of method sensitivity for data reporting purposes must be established by the Director of Quality Assurance and used consistently for all data reporting purposes.

8.1 ***Standard Operating Procedures***. Standard operating procedures (SOP) are prepared for routine methods executed by the laboratory and processes related to sample or data handling. The procedures describe the process steps in sufficient detail to enable an individual, who is unfamiliar with the procedure to execute it successfully. SOPs are reviewed annually and edited if necessary. SOPs can be edited on a more frequent basis if systematic errors dictate a need for process change or the originating regulatory agency promulgates a new version of the method. Procedural modifications are indicted using a revision number. SOPS are available for client review at the Accutest facility upon request.

8.1.1 ***Exception Policy*** With respect to the quality system, incoming non-conforming product refers to received samples that do not meet requirements of custody documentation, are improperly packaged or stored or are contaminated. An internal non-conformance refers to a problem, caused internally due to improper handling of samples, improper sampling methods, and equipment malfunction or data management errors. The individual who identifies the incoming non-conformance is responsible for notifying the project manager. The project manager resolves the issue with the client. The individual who recognizes an internal non-conformance is responsible for initiating corrective action (see also Section 14.2).

Departures from standard practices, policies and specifications are reviewed and approved by Technical Director, QA Officer and by Project Manager of the project affected.

8.1.2. ***Corrective & Preventative Action***

Once a quality problem has been identified, the analytical or review process stops, until the reason is identified. Primary responsibility for identifying the cause of the problem rests with the instrument operator. Other staff may be called on to assist in reaching the root cause. The problem prevention tracking system, using Corrective Action Tracking Records, provides a method to track systemic problems until resolved/removed. The QA Officer is responsible for the record management with respect to the disposition of problems.

Deviations that do not limit themselves to a single department and/or client are cited on Corrective Action Record. This may include but not limited to: sample arrival outside of EPA specified holding time, analysis completion outside of EPA specified holding time (with explanation of the reason), inconsistencies between chain of custody and cooler contents, including labeling errors, improper preservation, etc.

Deviations from analytical methods' SOP's are reported by the Analyst to the Section Leader. Single occurrences warrant completion of Corrective Action Tracking Record, repetitive occurrences may indicate that either an additional training session is in order, or the SOP does not reflect proper laboratory practice. Training session is conducted by the Technical Director or by QA Officer. In case where SOP does not reflect current laboratory practice, SOP review and correction process may be initiated.

8.2 ***Method Detection Limit Determination***. Annual method detection limit (MDL) studies are performed as appropriate for routine methods used in the laboratory. The procedure used for determining MDLs is described in 40 CFR, Part 136, Appendix B. Studies are performed for each method on water and soil matrices for every instrument that is used to perform the method. MDLs are established at the instrument level. The highest MDL of the pooled instrument data is used to establish a laboratory MDL. The quality assurance staff manages the annual MDL determination process and is responsible for retaining MDL data on file. Validity of MDL is evaluated using approximate 10X rule for majority of compounds for each method/matrix type. Accutest Laboratories Southeast does not report to the statistical MDL. MDL determination studies are conducted at the RL level for both the Organic and Inorganic methods.

8.3 ***Method Reporting Limit.*** The method reporting limit is established at the lowest concentration calibration standard in the calibration curve. The low calibration standard is selected by department managers as the lowest concentration standard that can be used while continuing to meet the calibration linearity criteria of the method being used. By definition, detected analytes at concentrations below the low calibration standard cannot be accurately quantitated and must be qualified accordingly.

8.4 ***Reporting of Quantitative Data.*** Analytical data for all methods is reported without qualification to the reporting limit established for each method. Data for organic methods may be reported to ½ the Reporting Limit depending upon the client's requirements provided that all qualitative identification criteria for the parameter have been satisfied. All parameters reported at concentrations between the reporting limit and ½ RL are qualified as an estimated concentration.

8.5 ***Precision and Accuracy Studies***. Annual precision and accuracy (P&A) studies, which demonstrate the laboratories ability to generate acceptable date, are performed for all routine methods used in the laboratory. The procedure used for generating organic P&A data is referenced in the majority of the regulatory methodology in use.

The procedure requires quadruplicate analysis of a sample spiked with target analytes at a concentration in the working range of the method. This data may be compiled from a series of existing blank spikes or laboratory control samples. Accuracy (percent recovery) of the replicate analysis is averaged and compared to established method performance limits. Values within method limits indicate an acceptable performance demonstration.

8.6 ***Method Selection.*** The Quality Assurance Staff maintains a list of active methods used for the analysis of samples. This list includes valid method references such as EPA, American Society of Testing and Materials (ASTM) or Standard Methods designations and the current version and version date.

Updated versions of approved reference methodology are placed into use as changes occur. The Quality Assurance Director informs operations management of changes in method versions as they occur. The operations management staff selects an implementation date. The operations staff is responsible for completing all method use requirements prior to the implementation date. This includes modification to SOPs, completion of MDL and precision and accuracy studies and staff training. Documentation of these activities is provided to the QA staff who retains this information on file. The updated method is placed into service on the implementation date and the old version is de-activated.

Multiple versions of selected methods may remain in use to satisfy client specific needs. In these situations, the default method version becomes the most recent version. Client specific needs are communicated to the laboratory staff using method specific analytical codes method, which clearly depict the version to be used. The old method version is maintained as an active method until the specified client no longer requires the use of the older version.

Accutest will not use methodology that represents significant departures from the reference method unless specifically directed by the client. In cases where clients direct the laboratory to use a method modification that represents a significant departure from the reference method, the request will be documented in the project file.

8.7 ***Analytical Capabilities***. Table 8.1 provides a detailed listing of the methodology employed for the analysis of test samples.

Table 8.1 – Analytical Capabilities and Method References

Method Type	Method Number	Regulatory Program
Organics – GC/MS:		
Volatile Organics	EPA 624	Clean Water Act
Semi-Volatile Organics	EPA 625	Clean Water Act
Liquid/Liquid Extraction, Water	SW846 – 3510C	RCRA
Solids Extraction by Sonication	SW846 – 3550B	RCRA
Acid/Base Partitioning	SW846 – 3650B	RCRA
Sulfur Cleanup of Extracts	SW846 – 3660B	RCRA
Purge & Trap - Aqueous	SW846 – 5030B	RCRA
Purge & Trap – Solids	SW846 – 5035	RCRA
Preservation & Extraction VOA	Methanol Preservation - VOA	NJDEP Draft Regulation
Volatile Organics	SW846 – 8260B	RCRA
Semi-Volatile Organics	SW846 – 8270C	RCRA
Organics – GC:		
EDB and DBCP – DW	EPA 504.1	Safe Drinking Water Act
Purgeable Halocarbons	EPA 601	Clean Water Act
Purgeable Aromatics	EPA 602	Clean Water Act
Chlorinated Pesticides & PCBs	EPA 608	Clean Water Act
Poly-Aromatic Hydrocarbons	EPA 610	Clean Water Act
Gasoline Range Organics	SW-846 – 8015B	RCRA
Diesel Range Organics	SW-846 – 8015B	RCRA
Oil Identification via Fingerprint	SW-846 – 8015B	RCRA
Volatile Aromatic/Halocarbons	SW-846 – 8021B	RCRA
Organochlorine Pesticides	SW-846 – 8081A	RCRA
Polychlorinated Biphenyls	SW-846 – 8082	RCRA
Volatile Petro. Hydrocarbons	Massachusetts VPH	MCP
Poly-Aromatic Hydrocarbons	SW-846 – 8310	RCRA
Explosives	SW-846 – 8330	RCRA
Explosives	SW-846 – 8332	RCRA
Metals:		
Total Recov. Metals Digestion	EPA 200.7	Clean Water Act
Non-Pot. Water Digest: ICP	SW846 3010A, EPA 1983	RCRA
Digestion of Soils for ICP	SW846 3050B	RCRA
ICP: General – EPA WW	EPA 200.7, 1983	Clean Water Act
ICP (General – SW846 update)	SW846 6010B	RCRA
GF AAS: General – EPA WW	EPA 200 Series (March 1983)	Clean Water Act
GF AAS SO (General)	SW846 7000 Series	RCRA
Cold Vapor Mercury – EPA WW	EPA 245.1, 1983	Clean Water Act
Cold Vapor Mercury – EPA DW	EPA 245.1, 1994	Safe Drinking Water Act
Cold Vapor Mercury – AQ	SW846 7470A	RCRA
Cold Vapor Mercury – Soils	SW846 7471A	RCRA
General Chemistry:		
Organic Matter – Loss on Ignition	AASHTO T267-86M	AASHTO Method
Oxidation-Reduction Potential	ASTM D1498-76, mod. for solids	ASTM Standard

Method Type	Method Number	Regulatory Program
Percent Ash (dry basis)	ASTM D2974-87, D482-91	ASTM Standard
Sieve Testing (ex hydrometer)	ASTM D422-63	ASTM Standard
Specific Gravity	ASTM D1298-85	ASTM Standard
Tetraethyl Lead in Soils & Waters	ASTM D3341-87, mod. for solids	ASTM Standard
Acidity	EPA 305.1	Clean Water Act
Alkalinity	EPA 310.1/SM18 2320B	Clean Water Act
BOD	EPA 405.1	Clean Water Act
Chloride – Titrametric	EPA 325.3/SW846 9252A	Clean Water Act
Color, Apparent	EPA 110.2	Clean Water Act
Dissolved Oxygen	EPA 360.1	Clean Water Act
Dissolved Silica	EPA 370.1	Clean Water Act
Fluoride	EPA 340.2	Clean Water Act
Hardness	EPA 130.2	Clean Water Act
Ion Chromatography (Bromide, Fluoride, Chloride, Sulfate, Nitrite, Nitrate, Sulfate) – Aqueous	EPA 300.0, SM18	Clean Water Act Safe Drinking Water Act
Mineral Suspended Solids	EPA 160.2/160.4	Clean Water Act
Total Kjeldahl Nitrogen	EPA 351.3	Clean Water Act
Ammonia	EPA 350.2	Clean Water Act
Nitrogen, Nitrite	EPA 354.1/SM18 4500NO2B	Clean Water Act
Odor	EPA 140.1	Clean Water Act
Oil & Grease, Gravimetric – AQ	EPA 1664	Clean Water Act
Orthophosphate	EPA 365.2/SM18 4500PE	Clean Water Act
Percent Solids	EPA 160.3	Clean Water Act
Petroleum Hydrocarbons – AQ	EPA 418.1	Clean Water Act
PH by electrode (Waters)	EPA 150.1	Clean Water Act
Phenols – chloroform extraction	EPA 420.1	Clean Water Act
Settleable Solids	EPA 160.5	Clean Water Act
Specific Conductance	EPA 120.1	Clean Water Act
Sulfate (Gravimetric)	EPA 375.3	Clean Water Act
Sulfate (Turbidimetric)	EPA 375.4	Clean Water Act
Sulfide	EPA 376.1	Clean Water Act
Sulfite	EPA 377.1	Clean Water Act
Total Dissolved Solids	EPA 160.1/SM18 2540C	Clean Water Act
Total Mineral Solids	EPA 160.4	Clean Water Act
Total Organic Carbon	EPA 415.1	Clean Water Act
Total Residual Chlorine	EPA 330.4/SM18 4500CLF	Clean Water Act
Total Solids	EPA 160.3	Clean Water Act
Total Suspended Solids	EPA 160.2	Clean Water Act
Total Volatile Solids	EPA 160.4	Clean Water Act
Turbidity	EPA 180.1	Clean Water Act
Volatile Suspended Solids	EPA 160.2/160.4	Clean Water Act
CN Amenable to Chlorination	EPA 335.1/2, SW846 9020	CWA or RCRA
Waste Ignitability	SW846 1010	CWA or RCRA
Ignitability – Shell Method	Shell Bunsen Burner	None – Client Method

Method Type	Method Number	Regulatory Program
Bicarbonate, Carbonate, CO2	SM18 4500 CO2D	None – Standard Method
Calcium Hardness by Calculation	SM18 2340B	None – Standard Method
Ferrous Iron	SM18 3500 FE-D	None – Standard Method
Free CO2 by Titrametric Method	SM18 4500 CO2 C	None – Standard Method
Hardness, Total by Calculation	SM18 2340B	None – Standard Method
Hexavalent Chromium (SM18)	SM18 4500 Cr D	None – Standard Method
Hydrogen Sulfide	SM19 4500S2-H	None – Standard Method
MBAS (Anionic Surfactants as)	SM18 5540C	None – Standard Method
Salinity	SM18 2520B	None – Standard Method
Total Nitrogen by calculation (TKN + NO32)	SM18 4500N	None – Standard Method
Total Organic Nitrogen by calculation (TKN – AMN)	SM18 4500N	None – Standard Method
Hexavalent Chromium/soils	SW846 3060/7196A (NJDEP)	None-NJDEP Modification
Ion Chromatography (Bromide, Fluoride, Chloride, Sulfate, Nitrite, Nitrate, Sulfate) – Solids	SW846 9056	RCRA
Corrosivity & pH – aqueous	SW846 9040B	RCRA
Corrosivity & pH – solid	SW846 9045B	RCRA
Waste Corrosivity	SW846 1110	CWA or RCRA
Hexavalent Chromium - soil	SW846 3060A/7196A	RCRA
Hexavalent Chromium - water	SW846 7196A	RCRA
Ignitability	SW846 Chp 7, SW1010, ASTM D93-90	RCRA
Oil & Grease, Gravimetric (Soils)	SW846 9071A M-Solids	RCRA
Paint Filter Test	SW846 9095	RCRA
Phenols (Lachat) with distillation	SW846 9066	RCRA
Synthetic Precipitation Leaching Procedure (SPLP)	SW846 1312	RCRA
Sulfide/Cyanide Reactivity	SW846 Chapter 7	RCRA
Toxicity Characteristics Leaching Procedure (TCLP)	SW846 1311	RCRA

9.0

SAMPLE MANAGEMENT, LOGIN, CUSTODY, STORAGE AND DISPOSAL

Requirement: A system to ensure that client supplied product is adequately evaluated, acknowledged, and secured upon delivery to the laboratory must be practiced by the laboratory. The system must assure that chain of custody is maintained and that sample receipt conditions and preservation status are documented and communicated to the client and internal staff. The login procedure must assign, document, and map the specifications for the analysis of each unique sample to assure that the requested analysis is performed on the correct sample and enables the sample to be tracked throughout the laboratory analytical cycle. The system must include procedures for reconciling defects in sample condition or client provided data, which occur at sample arrival. The system must specify the procedures for proper sample storage, transfer to the laboratory, and disposal after analysis. The system must be documented in a standard operating procedure.

9.1 ***Order Receipt and Entry***. New orders are initiated and processed by the client services group (See Chapter 14, Procedures for Executing Client Specifications). The new order procedure includes mechanisms for providing bottles to clients, which meet the size, cleanliness, and preservation specifications for the analysis to be performed.

For new orders, the project manager prepares a bottle request form, which is submitted to sample management. This form provides critical project details to the sample management staff, which are used to prepare and assemble the sample bottles for shipment to the client prior to sampling.

The bottle order is assembled using bottles that meet USEPA specifications for contaminant free sample containers. Accutest-SE uses a combination of pre-cleaned bottles, which are purchased from commercial suppliers and bottles that are checked for cleanliness. Precleaned bottle certificates are reviewed by both the analyst and sample management technician. Results of bottle analyses are retained for 5 years.

All preservative solution are prepared in the laboratory and are checked to assure that they are free of contamination from the compounds being analyzed before being released for use. Sample management department retains a copy of the documentation of in-house contamination checks.

Reagent water for trip and field blanks is poured into appropriately labeled containers. All bottles are packed into ice chests with blank chain of custody forms and the original bottle order from. Completed bottle orders are delivered to clients using Accutest couriers or commercial carriers for use in field sample collection.

9.2 ***Sample Receipt and Custody***. Samples are delivered to the laboratory using a variety of mechanisms including Accutest couriers, commercial shippers, and client self-delivery. Documented procedures are followed for arriving samples to assure that custody and integrity are maintained and that handling and preservation requirements are documented and continued.

Sample custody documentation is initiated when the individual collecting the sample collects field samples. Custody documentation includes all information necessary to provide an unambiguous record of sample collection, sample identification, and sample collection chronology. Initial custody documentation employs either Accutest or client generated custody forms.

Accutest generates a chain of custody in situations where the individuals who collected the sample did not generate custody documentation in the field.

Accutest defines sample custody as follows:

* The sample is in the actual custody or possession of the assigned responsible person,

* The sample is in a secure area.

The Accutest facility is defined as a secure facility. Perimeter security has been established, which limits access to authorized individuals only. Visitors enter the facility through the building lobby and must register with the receptionist prior to entering controlled areas. While in the facility, visitors must be accompanied by their hosts at all times. After hours, building access is controlled using a computerized pass-key reader system. This system limits building access to individuals with a pre-assigned authorization status. After hours visitors are not authorized to be in the building. Clients delivering samples after hours must make advanced arrangements through client services and sample management to assure that staff is available to take delivery and maintain custody.

Upon arrival at Accutest, the sample custodian reviews the chain of custody for the samples received to verify that the information on the form corresponds with the samples delivered. This includes verification that all listed samples are present and properly labeled, checks to verify that samples were transported and received at the required temperature, verification that the sample was received in proper containers, verification that sufficient volume is available to conduct the requested analysis, and a check of individual sample containers to verify test specific preservation requirements including the absence of headspace for volatile compound analysis.

Sample conditions and other observations are documented on the chain of custody by the sample custodian prior to completing acceptance of custody. The sample custodian accepts sample custody upon verification that the custody document is correct. Discrepancies or non-compliant situations are documented and communicated to the Accutest project manager, who contacts the client for resolution. The resolution is documented and communicated to sample management for execution.

9.3 ***Sample Tracking.*** An automated, electronic procedure in the LIMS records sample exchange transactions between departments and changes in analytical status. This system tracks all preparation, analytical, and data reporting procedures to which a sample is subjected while in the possession of the laboratory. Each individual receiving samples must acknowledge the change in custody and status in the LIMS. This step is required to maintain an accurate electronic record of sample status, dates of analytical activity, and custody throughout the laboratory.

Sample tracking is initiated at login where all chronological information related to sample collection dates and holding times are entered into the LIMS. This information is entered on an individual sample basis.

9.4 ***Sample Acceptance Policy***. Incoming samples must satisfy Accutest's sample acceptance criteria before being logged into the system. Sample acceptance is based on the premise that clients have exercised proper protocols for sample collection. This includes sufficient volume, proper chemical preservation, temperature preservation, sample container sealing and labeling, and appropriate shipping container packing.

The sample management staff will make every attempt to preserve improperly preserved samples upon arrival. However, if preservation is not possible, the samples may be refused unless the client authorizes analysis. No samples will be accepted if holding times have been exceeded or will be exceeded before analysis can take place unless the client authorizes analysis.

Sample acceptance criteria include proper custody and sample labeling documentation. Proper custody documentation includes an entry for all physical samples delivered to the laboratory with an identification code that matches the sample bottle and a date and signature of the individual who collected the sample and delivered them to the laboratory.
Accutest reserves the right to refuse any sample which in its sole and absolute discretion and judgement is hazardous, toxic and poses or may pose a health, safety or environmental risk during handling or processing.

9.5 ***Assignment of Unique Sample Identification Codes***. Unique identification codes must be assigned to each sample bottle to assure traceability and unambiguously identify the tests to be performed in the laboratory.

The sample identification coding process begins with the assignment of a unique alphanumeric job number. A job is defined as a group of samples received on the same day, from a specific client pertaining to a specific project. A job may consist of groups of samples received over multi-day period. The first character of the job number is an alpha-character that identifies the laboratory facility. The next characters are numeric and sequence by one number with each new job.

Unique sample numbers are assigned to each bottle collected as a discrete entity from a designated sample point. This number begins with the job number and incorporates a second series of numbers beginning at one and continuing chronologically for each point of collection. The test to be performed is clearly identified on the bottle label.

Alpha suffixes may be added to the sample number to identify special designations such as subcontracted tests, in-house QC checks, or re-logs. Multiple sample bottles for a specific analysis are labeled Bottle 1, Bottle 2, etc.

9.6 ***Subcontracted Analysis***. Subcontract laboratories are employed to perform analysis not performed by Accutest. The quality assurance staff evaluates subcontract laboratories to assure their quality processes meet the standards of the environmental laboratory industry prior to engagement. Throughout the subcontract process, Accutest follows established procedures to assure that sample custody is maintained and the data produced by the subcontractor meets established quality criteria.

Accutest network laboratories are considered primary subcontractors.

Subcontracting Procedure. Subcontracting procedures are initiated through several mechanisms, which originate with sample management. Samples for analysis by a subcontractor are logged into the Accutest system using regular login procedures. If subcontract parameters are part of the project or sample management has received subcontracting instructions for a specific project, a copy of the chain of custody is given to the appropriate project manager with the subcontracted parameters highlighted. This procedure triggers the subcontract process at the project management level. The project manager contacts an approved subcontractor to place the subcontract order. A subcontract order form (SOF) is simultaneously prepared in electronic format, by the project manager and filed with the original chain of custody. Client is notified in writing of the requirement to subcontract to the outside laboratory. The SOF and the subcontract chain of custody are forwarded to sample management, via E-Mail, for processing. A copy is filed with the original CoC.
Sample management signs the subcontract chain of custody and ships the sample(s) to the subcontractor. The subcontract COC is filed with the original COC and the request for subcontract. Copies are distributed to the login department, the project manager, and sample management.

Subcontractor data packages are reviewed by the QA Staff to assess completeness and quality compliance. If completeness defects are detected, the subcontractor is asked to immediately upgrade the data package. If data quality defects are detected, the package is forwarded to the QA staff for further review. The QA staff will pursue a corrective action solution before releasing data to the client.

Approved subcontract data is entered into the laboratory information management system (LIMS) if possible and incorporated into the final report. All subcontract data is footnoted to provide the client with a clear indication of its source. Copies of original subcontract data are included in the data report depending on the reporting level specified by the client

Subcontract Laboratory Evaluation. The QA staff evaluates subcontract laboratories prior to engagement. The subcontract laboratory must provide Accutest with a valid certification to perform the requested analysis, a copy of the laboratory Quality Systems Manual, copies of SOPs used for the subcontracted analysis, a copy of the most recent performance evaluation study for the subcontracted parameter, and copies of the most recent regulatory agency or third party accreditor audit report. Certification verification, audit reports and performance evaluation data must be submitted to Accutest annually. If possible, the QA staff conducts a site visit to the laboratory to inspect the quality system. Qualification of a subcontract laboratory may be bypassed if the primary client directs Accutest to employ a specific subcontractor.

9.7 ***Sample Storage***. Following sample custody transfer, samples are assigned to various refrigerated storage areas by the sample custodian depending upon the test to be performed and the matrix of the samples. The location (refrigerator and shelf) of each sample is recorded on the chain of custody adjacent to the line corresponding to each sample number and also entered into the LIMS. Samples remain in storage until the laboratory technician requests that they be transferred into the laboratory for analysis.

All internal Chains of Custody must be completed regardless of who performs the transfer.

Samples for volatile organics analysis are placed in storage in designated refrigerators by the sample custodian and immediately transferred to the organics group control. Sample custody is transferred to the department designee. These samples are segregated according to matrix to limit opportunities for cross contamination to occur.

Organics staff is authorized to retrieve samples from these storage areas for analysis. When analysis is complete, the samples are placed back into storage.

9.8 ***Sample Login***. Following sample custody transfer to the laboratory, the documentation that describes the clients analytical requirements are delivered to the sample login group for coding and entry to the Laboratory Information management System (LIMS). This process translates all information related to collection time, turnaround time, sample analysis, and deliverables into a code which enables client requirements to be electronically distributed to the various departments within the laboratory for scheduling and execution.

9.9 ***Sample Retrieval for Analysis***. Individual laboratory departments prepare and submit written requests to the sample custodian to retrieve samples for analysis. The sample custodian retrieves all samples except volatile organics and delivers them to the requesting department. Retrieval priorities are established by the requesting department and submitted to the sample custodian when multiple requests are submitted.

After sample analysis has been completed, the department requests pick-up and return of the sample to storage area. The sample custodian retrieves the sample and obtains written acknowledgement from the department of the transfer back to sample management or sample storage.

9.10 ***Sample Disposal***. Accutest retains all samples under proper storage for a minimum of 30 days following completion of the analysis report. Longer storage periods are accommodated on a client specific basis if required. Samples may also be returned to the client for disposal.

Accutest disposes of all laboratory wastes following the requirements of the Resource Conservation and Recovery Act (RCRA). The Company's has obtained and maintains a waste generator identification number, FLR00001263309002 (FLR designates State of Florida).

Sample management generates a sample disposal dump sheet from the LIMS tracking system each week, which lists all samples whose holding period has expired. Data from each sample is compared to the hazardous waste criteria established by the Florida Department of Environmental Protection (FDEP).

Samples containing constituents at concentrations above the criteria are labeled as hazardous and segregated into six separate waste categories for disposal as follows:

* Organic extracts: Chlorinated and non-chlorinated solvents
* Mixed flammable solvents (hexane, acetone, toluene, acetonitrile)
* Waste oil
* Soil (solids)
* Aqueous
* Corrosive waste

Non-hazardous aqueous samples are diluted and disposed directly into the laboratory sink. All aqueous liquids pass through a neutralization system before entering the municipal system.

Non-hazardous solids are disposed as municipal waste. Sample bottles are crushed prior to disposal to minimize waste volume and destroy sample labels.
Laboratory wastes are collected by waste stream in designated areas throughout the laboratory. Waste streams are consolidated daily by the waste custodian and transferred to stream specific drums for disposal through a permitted waste management contractor. Filled, consolidated drums are tested for hazardous characteristics and scheduled for removal from the facility for appropriate disposal based on the laboratory data.

10.0 LABORATORY INSTRUMENTATION AND MEASUREMENT STANDARDS

Requirement: Procedures, which assure that instrumentation is performing to a pre-determined operational standard prior to the analysis of any samples, must be established by the laboratory. In general, these procedures will follow the regulatory agency requirements established in promulgated methodology. These procedures must be documented and incorporated into the standard operating procedures for the method being executed.

10.1 ***Mass Tuning – Mass Spectrometers***. The mass spectrometer tune and sensitivity must be monitored to assure that the instrument is assigning masses and mass abundances correctly and that the instrument has sufficient sensitivity to detect compounds at low concentrations. This is accomplished by analyzing a specific mass tuning compound at a fixed concentration. If the sensitivity is insufficient to detect the tuning compound, corrective action must be performed prior to the analysis of standards or samples. If the mass assignments or mass abundances do not meet criteria, corrective action must be performed prior to the analysis of standards or samples.

10.2 ***Wavelength Verification – Spectrophotometers***. Spectrophotometer detectors are checked on a regular schedule to verify proper response to the wavelength of light needed for the test in use. If the detector response does not meet specifications, corrective action (detector adjustment or replacement) is performed prior to the analysis of standards or samples.

10.3 ***Inter-element Interference Checks (Metals)***. Inductively Coupled Plasma Emission Spectrophotometers (ICP) are subject to a variety of spectral interferences, which can be minimized or eliminated by applying interfering element correction factors and background correction points. Interfering element correction factors are checked on a specified frequency through the analysis of check samples containing high levels of interfering elements. Analysis of single element interferent solutions is also conducted at a specified frequency.

If the check indicates that the method criteria has not been achieved for any element in the check standard, the analysis is halted and data from the affected samples are not reported. Sample analysis is resumed after corrective action has been performed and the correction factors have been re-calculated.

New interfering element correction factors are calculated and applied whenever the checks indicate that the correction factors are no longer meeting criteria. At a minimum, correction factors are replaced once a year.

10.4 ***Calibration and Calibration Verification***. Many tests require calibration using a series of reference standards to establish the concentration range for performing quantitative analysis. Method specific procedures for calibration are followed prior to any sample analysis.

Calibration is performed using a linear regression calculation or calibration factors calculated from the curve. The calibration must meet method specific criteria for linearity or precision. If the criteria are not achieved, corrective action (re-calibration or instrument maintenance) is performed. The instrument must be successfully calibrated before analysis of samples can be conducted.

Initial calibration for metals analysis performed using inductively coupled plasma (ICP) employs the use of a single standard and a calibration blank to establish linearity. The calibration blank contains all reagents that are placed into the calibration standard with the exception of the target elements. Valid calibration blanks must not contain any target elements.

Initial calibrations must be initially verified using a single concentration calibration standard from a second source (i.e. separate lot or different provider). The continuing validity of an existing calibration must be regularly verified using a single concentration calibration standard. The response to the standard must meet pre-established criteria that indicate the initial calibration curve remains valid. If the criteria are not achieved corrective action (re-calibration) is performed before any additional samples may be analyzed.

10.5 ***Linear Range Verification and Calibration (ICP Metals)*** A linear range verification is performed for all ICP instrumentation. The regulatory program or analytical method specifies the verification frequency. A series of calibration standards are analyzed over a broad concentration range. The data from these analyses are used to determine the valid analytical range for the instrument. ICP instrument calibration is routinely performed using a single standard at a concentration within the linear range and a blank.

Some methods or analytical programs require a low concentration calibration check to verify that instrument is sufficient to detect target elements at the reporting limit. The analytical method or regulatory program defines the criteria used to evaluate the low concentration calibration check. If the low calibration check fails criteria, corrective action is performed and verified through reanalysis of the low concentration calibration check before continuing with the field sample analysis.

In accordance with NELAC standards minimum number of calibration points in the absence of method-specific requirements is two calibration points and a blank.

10.6 ***Retention Time Verification (GC/HPLC/IC)***. Chromatographic retention time windows are developed for all analysis performed using gas chromatographs with conventional detectors. The windows establish the time range required for the elution of a specified target analyte on the primary and confirmation columns. Retention times must be confirmed regularly through the analysis of an authentic standard. If the target analytes do not elute within the defined range, new windows are defined using the procedures described in the methodology.

10.7 *Equipment List*.

Table 10.7 Accutest Laboratories Equipment List

Organics			
Instrument	**Model**	**Serial #**	**Year**
GC/MS	Hewlett-Packard 5973 MSD/HP 7683 AS	US82311290	1999
GC/MS	Hewlett-Packard 5973 MSD/HP 7683 AS	US81211109	1998
GC/MS	Hewlett-Packard 5970 MSD/OI 4552/4560 Archon	2905A11904	1992
GC/MS	Hewlett-Packard 5970 MS/Tekmar 2000/2016 P&T	2728A12705	1992
GC/MS	Hewlett-Packard 5970 MSD/OI 4552/4560 Archon	2750A14680	1990
GC	Hewlett-Packard 6890/Dual ECD/HP 7683 AS	US00028304	1999
GC	Hewlett-Packard 5890/Dual FID/HP 7673 AS	3336A61096	1995
GC	Hewlett-Packard 5890/PID/ELCD/Tekmar 2000/2032 P&T	3336A60617	1995
GC	Hewlett-Packard 5890/Dual FID/HP 7673 AS	3336A59489	1995
GC	Hewlett-Packard 5890/PID/FID/Tekmar 2000/2032 P&T	3336A51045	1995
GC	Hewlett-Packard 5890/PID/ELCD/OI 4552/4560 Archon	3203A41646	1992
GC	Hewlett-Packard 5890/Dual FID/HP 7673 AS	3126A51085	1991
GC	Hewlett-Packard 5890/Dual ECD/HP 7673 AS	2921A24618	1990
GC	Hewlett-Packard 5890/PID/FID/Tekmar 2000/2032 P&T	3029A29748	1990
GC	Hewlett-Packard 5890/FID	2843A20183	1988
GC	Hewlett-Packard 5890/Dual ECD/HP 7673 AS	2728A14096	1987
HPLC	Hewlett-Packard 1050Q Automated LC System	3149G01430	1996
O-Prep	TurboVap	TV0109R10167	2001
O-Prep	TurboVap	TV0123N10343	2001
O-Prep	TurboVap	TV0126N10373	2001
O-Prep	Midi-Vap 2000 Kontes	479200-2000	2000
Data System	Hewlett-Packard/EnviroQuant		1999

Inorganics			
Instrument	**Model**	**Serial #**	**Year**
ICP	TJA EnviroTrace 61E Simultaneous	470790	1997
ICP	Leeman PS 3000 Simultaneous/Sequential	60600	1990
GFAA	Perkin-Elmer 5100 Zeeman/Graphite Furnace	141000	1990
Mercury Analyzer	Leeman PS 200	3030	1998

Mercury Analyzer	Bacharach Coleman 50D	YM0500	1995
IC	Dionex DX-500	99030664	1999
Spectrophotometer	Milton-Roy Spectronic 200		2000
Auto Analyzer	Alpkem RFA 300	000143	1986

LIMS		
Instrument	**Model**	**Year**
LIMS	Compaq True 64 DS-20/Oracle Data Base	1999

11.0 INSTRUMENT MAINTENANCE

Requirement. Procedures must be established for equipment maintenance. The procedure may include a maintenance schedule if required or documentation of daily maintenance related activities. All instrument maintenance activities must be documented in instrument specific logbooks.

11.1 ***Routine, Daily Maintenance***. Routine, daily maintenance is required on an instrument specific basis. It is performed each time the instrument is used. Daily maintenance traditionally includes activities to insure a continuation of good analytical performance. In some cases, they include performance checks that indicate whether non-routine maintenance is required. If the performance check indicates a need for higher level maintenance, the equipment is taken out of service until maintenance is performed. Analysis cannot be continued until the performance checks meet established criteria. Daily maintenance is the responsibility of the individual assigned to the instrument used for the analysis he is performing.

11.2 ***Non-routine Maintenance***. Non-routine maintenance is reserved for catastrophic occurrences such as instrument failure. The need for non-routine maintenance is indicated by failures in general operating systems, that result in an inability to conduct required performance checks or calibration. Equipment in this category are taken out of service and repaired before attempting further analysis. Analysis cannot continue until the instrument meets all performance check criteria and is capable of being calibrated. Section supervisors are responsible for identifying non-routine maintenance episodes and initiating repair activities to bring the equipment on-line. This may include initiating telephone calls to maintenance contractors if necessary. They are also responsible for documenting all details related to the occurrence and the repair.

11.3 ***Scheduled Maintenance***. Modern laboratory instrumentation rarely requires regular preventative maintenance. Where required, the equipment is placed on a schedule, which dictates when maintenance is required. Examples include annual balance calibration by an independent provider and optical alignment of the ICP. Section supervisors are responsible for initiating scheduled maintenance on equipment that requires scheduled preventative attention. Scheduled maintenance is documented using routine documentation practices.

11.4 ***Maintenance Documentation***. Routine and non-routine maintenance activities are documented in logbooks assigned to instruments and equipment used for analytical measurements. The logbooks contain preprinted forms, which specify the maintenance activities required with each use. The analyst or supervisor who performs or initiates the maintenance activity is required to check the activity upon its completion and initial the form. Non-routine maintenance (i.e. repairs, upgrades, etc.) is documented in a separate service log.

12.0 QUALITY CONTROL PARAMETERS, PROCEDURES, AND CORRECTIVE ACTION

Requirement: All procedures used for test methods must incorporate quality control parameters to monitor elements that are critical to method performance. Each quality parameter includes acceptance criteria that have been established by regulatory agencies for the methods in use. Criteria may also be established through client dictates or through the accumulation and statistical evaluation of internal performance data. Data obtained from these parameters must be evaluated by the analyst, and compared to established method criteria. If the criteria are not achieved, the procedures must specify corrective action and conformation of control before proceeding with sample analysis. QC parameters, procedures, and corrective action must be documented within the standard operating procedures for each method. In the absence of client specific objectives the laboratory must define qualitative objectives for completeness and representativeness of data.

12.1 ***Procedure***. Bench analysts are responsible for methodological quality control and sample specific quality control. Each method specifies the control parameters to be employed for the method in use and the specific procedures for incorporating them into the analysis. These control parameters are analyzed and evaluated with every designated sample group (batch).

The data from each parameter provides the analyst with critical decision making information on method performance. The information is used to determine if corrective action is needed to bring the method or the analysis of a specific sample into compliance. These evaluations are conducted throughout the course of the analysis. Each parameter being indicative of a critical control feature. Failure of a methodological control parameter is indicative of either instrument or batch failure. Failure of a sample control parameter is indicative of control difficulties with a specific sample or samples.

Sample Batch. All samples analyzed in the laboratory are assigned to a designated sample batch, which contains all required quality control samples and a defined maximum number of field samples that are prepared and/or analyzed over a defined time period. The maximum number of field and quality control samples in the batch is 20. The typical batch contains a blank, laboratory control sample (LCS or spiked blank), matrix spike and matrix spike duplicate. Batch documentation includes lot specifications for all reagents and standards used during preparation of the batch.

12.2 ***Methodological Control Parameters and Corrective Action***. Prior to the analysis of field sample the analyst must determine that the method is functioning properly. Specific control parameters indicate whether critical processes meet specified requirements before continuing with the analysis. Method specific control parameters must meet criteria before sample analysis can be conducted. Each of these parameters is related to processes that are under the control of the laboratory and can be adjusted if out of control.

Method Blank. A method blank is analyzed during the analysis of any field sample. The method blank is defined as a sample. It contains the same standards (internal standards, surrogates, matrix modifiers, etc.) and reagents that are added to the field sample during analysis, with the exception of the sample itself. If the method blank contains target analytes(s) at concentrations that exceed method or client requirements (typically defined as method detection limit concentrations), the source of contamination is eliminated before proceeding with sample analysis. In specific cases, contamination detected in the method blank may be acceptable if the concentrations do not exceed regulatory limits or client defined reporting limits.

Laboratory Control Samples (LCS or Spiked Blanks). A laboratory control sample (spiked blank or commercially prepared performance evaluation sample) is analyzed along with field samples to demonstrate that the method accuracy is within acceptable limits. These spike solutions are derived from different sources than the solutions used for method calibration. The performance limits are derived from published method specifications or from statistical controls generated from laboratory method performance data. Spiked blanks are blank matrices (reagent water or clean sand) spiked with the targeted parameters and analyzed using the same method used for samples. Accuracy data is compared to laboratory derived limits to determine if the method is in control. Laboratory control samples (LCS) are commercially prepared spiked samples in an inert material. Performance criteria for recovery of spiked analytes is pre-established by the commercial entity preparing the sample. This sample is analyzed in the laboratory as an external reference.

Accuracy data is compared to the applicable performance limits. If the spike accuracy exceeds the performance limits, corrective action, as specified in the SOP for the method is performed and verified before continuing with a field sample analysis. In some cases, decisions are made to continue with sample analysis if performance limits are exceeded; provided the unacceptable result has no negative impact on the sample data.

Blanks and spikes are routinely evaluated before samples are analyzed. However, in situations where sample analysis is performed using an autosampler, they may be evaluated after sample analysis has occurred. If the blanks and spikes do not meet criteria, sample analysis is repeated.

Proficiency Testing. Performance evaluation samples (PEs) are single or double blind spikes, introduced to the laboratory to assess method performance. PEs may be introduced as double blinds submitted by commercial clients, single or double blinds from regulatory agencies, or internal blinds submitted by the QA group.

A minimum of two single blind studies must be performed each year for every parameter in aqueous and solid matrices for each field of testing for which the laboratory maintains accreditation. Proficiency samples must be purchased as blinds from an NIST NVLAP accredited vendor. Data from these studies are provided to the laboratory by the vendor and reported to accrediting agencies. If unsatisfactory performance is noted, corrective action is performed to identify and eliminate any sources of error. A new single blind must be analyzed to demonstrate continuing proficiency.

PE samples performed for accrediting agencies or clients, which do not meet performance specifications, require a written summary that documents the corrective action investigation, findings, and corrective action implementation.

Single or double blind proficiency test samples are employed for self-evaluation purposes. Data from these analyses are compared to established performance limits. If the data does not meet performance specifications, the system is evaluated for sources of acute or systematic error. If required, corrective action is performed and verified before initiating or continuing sample analysis.

Trend Analysis for Control Parameters. Accuracy data for selected spiked parameters from the laboratory control sample (LCS) is statistically evaluated daily for trends. Data from selected LCS parameters and surrogates are pooled on a method, matrix, and instrument basis. This data is evaluated by comparison to existing control and warning limits. Trend analysis is performed automatically as follows:

- Any point outside the control limit
- Any three consecutive points between the warning and control limits
- Any eight consecutive points on the same side of the mean.
- Any six consecutive points increasing or decreasing

The results of the trend analysis are printed for supervisory evaluation prior to sample analysis. Trends that indicate the potential loss of statistical control are further evaluated to determine the impact on data quality and to determine if corrective action is necessary. If corrective action is indicated, the supervisor informs the analysts of the corrective actions to be performed. Return to control is demonstrated before analysis resumes.

12.3 ***Sample Control Parameters and Corrective Action***. The analysis of samples can be initiated following a successful demonstration that the method is operating within established controls. Additional controls are incorporated into the analysis of each sample to determine if the method is functioning within established specifications for each individual sample. Sample QC data is evaluated and compared to established performance criteria. If the criteria are not achieved the method or the SOP specifies the corrective action required to continue sample analysis. In many cases, failure to meet QC criteria is a function of sample matrix and cannot be remedied. Each parameter is designed to provide quality feedback on a defined aspect of the sampling and analysis episode.

Duplicates. Duplicate sample analysis is used to measure analytical precision. This can also be equated to laboratory precision for homogenous samples. Precision criteria are method dependent. If precision criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

Laboratory Control Duplicate, Spikes & Spiked Duplicates. Spikes and spiked duplicates are used to measure analytical precision and accuracy for the sample matrix selected. Precision and accuracy criteria are method dependent. If precision and accuracy criteria are not achieved, corrective action or additional action may be required. Recommended action must be completed before sample data can be reported.

Serial Dilution (Metals). Serial dilutions of metals samples are analyzed to determine if analytical matrix effects may have impacted the reported data. If the value of the serially diluted samples does not agree with the undiluted value within a method-specified range, the sample matrix may be causing interference, which may lead to either a high or low bias. If the serial dilution criterion is not achieved, it must be flagged to indicate possible bias from matrix effects. *Accutest-SE uses this procedure as opposed to post-digestion spike.*

Post Digestion Spikes. Digested samples are spiked and analyzed to determine if matrix interferences are creating biases in the results. If the value of the spike is outside the control limits established in the method, the sample is diluted and re-analyzed as a spiked and unspiked sample to minimize the impact of the sample matrix on the analysis. The process is repeated until the post spike accuracy meets the method criteria.

Method of Standard Addition. The method of additions may be used to eliminate interferences for metals analysis performed by graphite furnace if the matrix interference is not eliminated with dilutions. Known, fixed amounts of different standards are added to several aliquot of a sample immediately prior to analysis. The sample aliquots are analyzed in sequence. A linear regression is calculated for the aliquots. The absolute value of the negative x-intercept is defined as the sample value. MSA criteria is satisfied if the linear regression correlation coefficient is 0.995 or better and the associated method blank value is less than the detection limit.

Surrogate Spikes (Organics). Surrogate spikes are organic compounds that are similar in behavior to the target analytes but unlikely to be found in nature. They are added to all quality control and field samples to measure method performance for each individual sample. Surrogate accuracy limits are derived from published method specifications or by statistical evaluation of laboratory generated surrogate accuracy data. Accuracy data is compared to the applicable performance limits. If the surrogate accuracy exceeds performance limits, corrective action, as specified in the method or SOP is performed before sample data can be reported.

Internal Standards (Organic Methods). Internal standards are retention time and instrument response markers added to every sample to be used as references for quantitation. Their response is compared to reference standards and used to evaluate instrument sensitivity on a sample specific basis. Internal standard retention time is also compared to reference standards to assure that target analytes are capable of being located by their individual relative retention time.

If internal standard response criteria are not achieved, corrective action or additional action may be required. The recommended action must be completed before sample data can be reported.

If the internal standard retention time criteria are not achieved corrective action or additional action may be required. This may include re-calibration and re-analysis. Additional action must be completed before sample data is reported.

Internal Standards (ICP Metals). Internal standards are used on some ICP instruments to compensate for variations in response caused by differences in sample matrices. This adjustment is performed automatically during sample analysis. The internal standard response of replicated sample analysis is monitored to detect potential analytical problems. If analytical problems are suspected, then the field samples are reanalyzed.

12.4 ***Laboratory Derived Quality Control Criteria.*** Control criteria for in-house methods and client specific modifications that exceed the scope of published methodology are defined and documented prior to the use of the method. The responsibility for control criteria needs is identified by the Quality Assurance Director. Control parameters and criteria, based on best technical judgement are established using input provided by the operations staff. These control parameters and criteria are documented and incorporated into the method.

The laboratory derived criteria are evaluated for technical soundness on spiked samples prior to the use of the method on field samples. The technical evaluation is documented and archived by the Quality Assurance Staff.

When sufficient data form the laboratory developed control parameter is accumulated, the data is statistically processed and the experimentally derived control limits are incorporated into the method.

12.5 ***Bench Review & Corrective Action***. The bench chemists are responsible for all QC parameters. Before proceeding with sample analysis, they are required to successfully meet all instrumental QC criteria. They have the authority to perform any necessary corrective action before proceeding with sample analysis. Their authority includes the responsibility for assuring that departures from documented policies and procedures do not occur.

The bench chemists are also responsible for all sample QC parameters. If the sample QC criteria are not achieved, they are authorized and required to perform the method specified corrective action before reporting sample data.

12.6 ***QA Monitoring***. The QA staff prior to client release conducts a spot review of completed data packages. This review includes an examination of QC data for compliance and trends indicative of systematic difficulties. If non-conformances are detected, the QA staff places an immediate stop on the release of the data and initiates corrective action to rectify the situation. The data package is released when the package becomes compliant with all quality requirements.

If the review reveals trends indicative of systematic problems, QA initiates an investigation to determine the cause. If process defects are detected, a corrective action is implemented and monitored for effectiveness.

Performance Limits. The Quality Assurance Officer is responsible for compilation and maintenance of all precision and accuracy data used for performance limits. Quality control data for all test methods are accumulated and stored in the laboratory information management system (LIMS). Parameter specific QC data is extracted annually and statically processed to eliminate outliers and develop laboratory specific warning limits and confidence limits. The new limits are reviewed and approved by the supervisory staff prior to their use for data assessment. The new limits are used to evaluate QC data for compliance with method requirements for a period of one year. Laboratory generated limits appear on all data reports.

12.7 ***Data Package Review***. Accutest employs multiple levels of data review to assure that reported data has satisfied all quality control criteria and that client specifications and requirements have been met. Three departments have data review requirements, which must be conducted before data is released to the client.

Analytical Review. The analyst conducts the primary review of all data. This review begins with a check of all instrument and method quality control and progresses through sample quality control concluding with a check to assure that the client's requirements have been executed. The analyst has the authority and responsibility to perform corrective action for any out-of-control parameter or nonconformance at this stage of review.

Secondary data reviews are performed at the peer level by analysts who have met the qualification criteria for the method in use. Qualification requirements include a valid demonstration of capability and demonstrated understanding of the method SOP. Section supervisors may perform secondary review in-lieu of a peer review Supervisors review 100% of the data produced by their department. It includes a check of all manual calculations; an accuracy check of manually transcribed data from bench sheets to the LIMS, a check of all QC criteria and a comparison of the data package to client specified requirements. Supervisors have the authority to reject data and initiate re-analysis, corrective action, or reprocessing.

All laboratory data requiring manual entry into LIMS system is double checked by the analysts performing initial data entry and the section supervisor. Verification of supervisory review is indicated on the raw data summary by the supervisor's initials and date.

Electronic data that is manually edited at the bench by the primary analysts is automatically flagged by the instrument data system indicating an override by the analyst. All manual overrides must be verified and approved by a supervisor who initials and dates all manual changes.

Hard copies of manually integrated chromatographic peaks are printed that clearly depict the manually drawn baseline. The hard copy is reviewed and approved by the section supervisor (initialed and dated) and included in the data package of all full tier reports or the archived batch records of commercial report packages.

Electronic data that has been committed to the LIMS can only be edited by a manager or supervisor. These edits may be required if needs for corrections are indicated during the final review. An audit record for all electronic changes in the LIMS is automatically appended to the record.

The group manager performs a tertiary review on a spot check basis. This review includes an evaluation of QC data against acceptance criteria and a check of the data package contents to assure that all analytical requirements and specifications were executed.

Report Generation Review. The report generation group reviews all data and supporting information delivered by the laboratory for completeness and compliance with client specifications. Missing deliverables are identified and obtained from the laboratory. The group also reviews the completed package to verify that the delivered product complies with all client specifications. Non-analytical defects are corrected before the package is sent to the client.

Project Management/Quality Assurance Review. Spot-check data package reviews are performed by the project manager. Project management reviews focus on project specifications. If the project manager identifies defects in the product prior to release, he initiates immediate corrective action to rectify the situation.

The QA Staff reviews approximately 10% of the data produced. The QA review focuses on all elements of the deliverable including the client's specifications and requirements, analytical quality control, sample custody documentation and sample identification. QA reviews at this step in the production process are geared towards systematic process defects, which require procedural changes to effect a corrective action. However, if defects are identified that can be corrected prior to data release, the QA staff returns the package to the laboratory for corrective action. QA data review cannot be used in lieu of a peer level review or a supervisory review.

Data Reporting. Analytical data is released to clients following a secondary review by the group supervisor. Data release at this stage of the process is limited to electronic information, which is released to clients through a secure, encrypted, password protected, Internet connection.

Hard copy support data is compiled by the report generation group and assembled into the final report. The report is sent to the client following reviews by report generation, quality assurance, and the company president.

12.8 ***Electronic Data Reduction.*** Raw data from sample analysis is entered into the laboratory information management system (LIMS) using automated processes or manual entry. Final data processing is performed by the LIMS using procedures developed by the Company.

All LIMS programs are tested and validated prior to use to assure that they consistently produce correct results. Validation testing is performed by the Information Technology Staff. The testing procedures are documented in an SOP. Programs are not approved for use until they have demonstrated that they are capable of performing the required calculations.

12.9 ***Representativeness***. Data representativeness is based on the premise that qualitative and quantitative information developed for field samples is characteristic of the sample that was collected by the client and analyzed in the laboratory. The laboratory objective for representativeness defines data as representative if the criteria for all quality parameters associated with the analysis of the sample are achieved.

12.10 ***Comparability***. Analytical data is defined as comparable when data from a sample set analyzed by the laboratory is representatively equivalent to other sample sets analyzed separately regardless of the analytical logistics. The laboratory will achieve 100% comparability for all sample data which meets the criteria for the quality parameters associated with its analysis using the method requested by the client.

13.0 CORRECTIVE ACTION SYSTEM

Requirement. The laboratory must have polices and procedures for correcting defective processes, systematic errors, and quality defects, which enables the staff to systematically improve product quality. The system must include procedures for communicating items requiring corrective action, corrective action tracking procedures, corrective action documentation, monitoring of effectiveness, and reports to management. The system must be documented in a standard operating procedure.

13.1 ***Procedure***. Corrective action is the step that follows the identification of a process defect. The type of defect determines the level of documentation, communication, and training necessary to prevent re-occurrence of the defect or non-conformance.

Routine Corrective Action. Routine corrective action is defined as the procedures used to return out of control analytical systems back to control. This level of corrective action applies to all analytical quality control parameters or analytical system specifications.

Bench analysts have full responsibility and authority for performing routine corrective action. The resolution of defects at this level does not require a procedural change or staff re-training. The analyst is free to continue work once corrective action is complete and the analytical system has been returned to control.

13.2 **Procedural Modifications**. Corrective actions in this category require process change. They may be the result of systematic defects identified during audits, the investigation of client inquiries, product defects identified during data review, or method updates. Resolution of defects of this magnitude require formal identification of the defect, development and documentation of a corrective action plan, and staff training to communicate the procedural change.

13.3 ***Documentation & Communication***. Routine corrective actions are documented as part of the analytical record. Notations are made in the comments section of the analytical chronicle or data sheet detailing the nonconformance. Continuation of the analysis indicates that return to control was successful.

Corrective actions for process changes are documented, tracked and monitored for effectiveness. Corrective actions may be initiated by any supervisor or senior staff member by completing the corrective action form.

The corrective action form is maintained as an electronic document. Copies of the completed form are distributed to the responsible parties and the QA staff via E-mail. QA assigns a tracking number to the corrective action and copies the Corrective Action form to the corrective action directory of the QA directory on the network server. The QA staff also maintains a logbook to track all Corrective Actions.

The responsible party develops and implements the procedural change. Existing documentation such as SOPs are edited to reflect the change. The affected staff is informed of the procedural change through a formal training session. The training is documented and copies are placed into individual training files. The corrective action form is completed and returned to the QA staff for archiving.

Initial and completed corrective action forms are maintained in the Corrective action directory. This information is archived daily. The corrective action tracking form is maintained by QA as a running tracking form in the Corrective action directory. Copies of training records describing corrective actions are appended to the involved individuals training files.

Monitoring. The QA Staff monitors the implemented corrective action until it is evident that the corrective action has been affective. and it is apparent that the corrective action was effective and the systematic deficiency has been eliminated. If QA determines that the corrective action procedure has not effectively remedied the deficiency, the process continues with new documentation describing the deficiency. Corrective action continues until the defective process is eliminated. If another procedural change is required, it is treated as a new corrective action, which is documented and monitored using established procedures.

14.0 PROCEDURES FOR EXECUTING CLIENT SPECIFICATIONS

Requirement. Systems must be established for evaluating and processing client specifications for routine and non-routine analytical services. The systems must enable the client services staff to identify, evaluate, and document the requested specifications to determine if adequate resources are available to perform the analysis. The system must include procedures for communicating the specifications to the laboratory staff for execution and procedures for verifying the specifications have been executed.

14.1 ***Client Specific Requirements***. The project manager is the primary contact for clients requesting laboratory services. Client specifications are communicated using several mechanisms. The primary source of information is the client's quality assurance project plan (QAPjP) which details analytical and quality control specifications for the project. In the absence of a QAPjP, projects specifications can also be communicated using contracts, letters of authorization, or letters of agreement, which may be limited to a brief discussion of the analytical requirements and the terms and conditions for the work. These documents may also include pricing information, liabilities, scope of work, in addition to the analytical requirements. QAPjPs include detailed analytical requirements and data quality objectives, which supersede those found in the referenced methods. This information is essential to successful project completion.

The project manager is responsibility for obtaining project documents, which specify the analytical requirements. Following project management review, copies are distributed to the QA Director and the appropriate departmental managers for review and comment. The original QAPP is numbered with a document control number and filed in a secure location.

14.2 ***Requirements for Non-Standard Analytical Specifications***. Client requirements that specify departures from documented policies, procedures, or standard specifications must be submitted to Accutest in writing. These requirements are reviewed and approved by the technical staff before the project is accepted. Once accepted, the non-standard requirements become analytical specifications, which follow the routine procedure for communicating client specifications. Departures from documented policies, procedures, or standard specifications that do not follow this procedure are not permitted.

14.3 ***Evaluation of Resources.*** A resource evaluation is completed prior to accepting projects submitted by clients. The evaluation is initiated by the client services staff who prepares a brief synopsis that includes the logistical requirements of the project. Logistical specifications for new projects are summarized in writing for evaluation by the affected departments. The specification are evaluated by the department manager from a scheduling and hardware resources perspective. The project is not accepted unless the department managers have the necessary resources to execute the project according to client specifications.

14.4 ***Documentation***. New projects are initiated using a project set up form, which is completed prior to the start of the project. This form details all of the information needed to correctly enter the specifications for each client sample into the laboratory information management system (LIMS, see example). The form includes data reporting requirements, billing information, data turnaround times, QA level, state of origin, and comments for detailing project specific requirements. The project manager is responsible for obtaining this information from the client and completing the form prior to sample arrival and login.

Sample receipt triggers project creation and the login process. The information on the set-up form is entered into the LIMS immediately prior to logging in the first sample. The set up form may be accompanied by a quotation, which details the analytical product codes and sample matrices. These details are also entered into the LIMS during login.

Special information is distributed to the laboratory supervisors and login department in electronic or hardcopy format upon project setup. All, project specific information is retained by the project manager in a secure file. The project manager maintains a personal telephone log, which details conversations with the client regarding the project.

14.5 ***Communication***. A pre-project meeting is held between client services and the operations managers to discuss the specifications described in the QAPjP and/or related documents. Project logistics are discussed and finalized and procedures are developed to assure proper execution of the client's analytical specifications and requirements. Questions, raised in the review meeting, are discussed with the client for resolution. Exceptions to any requirements, if accepted by the client, are documented and incorporated into the QAPjP or project documentation records.

Non-standard specifications for individual clients are documented in the LIMS at the client account level. Once entered into the LIMS, these specifications become memorialized for all projects related to the client account. Upon sample arrival, these specifications are accessed through a terminal or printed as a hard copy and stored in a binder for individuals who require access to the specification. Specifications that are not entered into the LIMS are prohibited unless documented in an interdepartmental memo, which clearly identifies the project, client and effective duration of the specification.

14.6 ***Operational Execution***. A work schedule is prepared for each analytical department on a daily basis. Analytical specifications from recently arrived samples have now been entered into the LIMS database. The database is sorted by analytical due date and holding time, into product specific groups. Samples are scheduled for analysis by due date and holding time. The completed schedule, which is now defined as a work list, is printed. The list contains the client requested product codes and specifications required for the selected sample(s). Special requirements are communicated to the analyst using the comments section or relayed through verbal instructions provided by the supervisor. The bench analyst assumes full responsibility for performing the analysis according to the specifications printed on the work sheet.

14.7 ***Verification***. Prior to the release of data to the client, laboratory section managers and the report generation staff review the report and compare the completed product to the client specifications documentation to assure that all requirements have been met. Project managers perform a spot check of projects with unique requirements to assure that the work was executed according to specifications.

15.0

CLIENT COMPLAINT RESOLUTION PROCEDURE

Requirement. A system for managing and reconciling client complaints must be implemented in the laboratory. The system must include procedures for documenting client complaints and communicating the complaint to the appropriate department for resolution. The system must also include a quality assurance evaluation to determine if the complaint is related to systematic defects requiring process changes.

15.1 ***Procedure***. Client complaints are communicated to client services representatives, quality assurance staff, or senior management staff for resolution. The individual receiving the complaint retains the responsibility for documentation and communicating the nature of the complaint to the responsible department(s) for resolution. The responsible party addresses the complaint. The resolution is communicated to quality assurance (QA) and the originator for communication to the client. QA reviews the complaint and resolution to determine if systematic defects exist. If systematic defects are present, QA works with the responsible party to develop a corrective action that eliminates the defect.

15.2 ***Documentation***. Client's complaints are documented by the individual receiving the complaint using the Data Query and Corrective Action Inquiry Form. This form is an Excel spreadsheet that contains detailed information essential to the complaint resolution. A record of the telephone conversation is maintained by client services. The form is distributed by E-Mail to QA and the party responsible for resolution. The complaint resolution is documented on the form by the responsible party and returned to the originator. A copy is sent to QA for review and database archiving.

15.3 ***Corrective Action***. Responses to data queries are required from the responsible party. At a minimum, the response addresses the query and provides an explanation to the complaint. Corrective action may focus on the single issue expressed in the complaint. Corrective action may include reprocessing of data, editing of the initial report, and re-issue to the client. If the QA review indicates a systematic error, process modification is required. The defective process at the root of the complaint is changed. SOPs are either created or modified to reflect the change. The party responsible for the process implements process changes.

15.4 ***QA Monitoring***. Process changes, implemented to resolve systematic defects, are monitored for effectiveness by QA. If monitoring indicates that the process change has not resolved the defect, QA works with the department management to develop and implement an effective process. If monitoring indicates that the defect has been resolved, monitoring is slowly discontinued. Continued monitoring is incorporated as an element of the annual system audit.

16.0 CONFIDENTIALITY PROTECTION PROCEDURES

Requirements: Policies and procedures are required to protect client data from release to unauthorized parties or accidental release of database information through accidental electronic transmission or illegal intrusion. These policies must be communicated to clients and staff. Electronic systems must be regularly evaluated for effectiveness.

16.1 ***Client Anonymity***. Information related to the Company's clients is granted to employees on a "need to know" basis. An individual's position within the organization defines his "need to know". Individuals with "need to know" status are given password access to systems that contain client identity information and access to documents and document storage areas containing client reports and information. Access to client information by individuals outside of the Company is limited to the client and individuals authorized by the client.

Individuals outside of the Company may obtain client information through subpoena issued by a court of valid jurisdiction. Clients are informed when subpoenas are received ordering the release of their information.

16.2 ***Documents***. Access to client documents is restricted to employees in need to know positions. Copies of all client reports are stored in secure archive with restricted access. Reports and report copies are distributed to individuals who have been authorized by the client to receive them. Documents are not released to third parties without verbally expressed or written permission from the client.

16.3 ***Electronic Data***.

Database Intrusion. Direct database entry is authorized for employees of Accutest only on a need to know basis. Entry to the database is restricted through a user specific multiple password entry system. Direct access to the database outside of the facility is possible through a dial-up connection. A unique password is required for access to the local area network. A second unique password is required to gain access to the database. The staff receives read or write level authorization on a hierarchical privilege basis.

Internet Access. Access to client information is through an HTTP Web application only. It does not contain a mechanism that allows direct access to the database. Clients can gain access to their data only using a series of Accutest assigned, client and user specific passwords. The viewable data, which is encrypted during transmission, consists of an extraction of database information only.

Client Accessibility. Accessibility to client data delivered via electronic means follows strict protocols to insure confidentiality. Clients accessing electronic data are assigned a company account. The account profile, which is established by the MIS staff, grants explicit access to explicit information pertaining to the clients project activity. Passwords are assigned on an individual basis within a client account. These accounts can be activated or deactivated by the MIS staff only.

16.4 ***Information Requests***. Client specific data or information is not released to third parties without verbally expressed or written permission from the client. Written permission is required from third parties, who contact the Company directly for the release of information. Verbal requests will be honored only if they are received directly from the client. These requests must be documented in a record of communication maintained by authorization recipient.

17.0 QUALITY AUDITS AND SYSTEM REVIEWS

Requirement: The quality assurance group will conduct regularly scheduled audits of the laboratory to assess compliance with quality system requirements, technical requirements of applied methodology, and adherence to documentation procedures. The information gathered during these audits will be used to provide feedback to senior management and perform corrective action where needed for quality improvement purposes.

17.1 ***Quality Systems Audits***. Quality system audits are performed annually by the Quality Assurance Director for the Company President. In this audit, the laboratory is evaluated for compliance with the Laboratory Quality Systems Manual (LQSM) and the quality system standards of the National Environmental Laboratory Accreditation Conference. Findings, which indicate non-compliance or deviation from the LQSM, are flagged for corrective action. Corrective actions require either a return to compliance or a plan change to reflect an improved quality process. The Quality Assurance Director is responsible for making and documenting changes to the LQSM. These changes are reviewed by the Company President and The Laboratory Director prior to the approval of the revised system.

17.2 ***Technical Compliance Audits***. Technical compliance audits are performed semi-annually. Selected analytical procedures are evaluated for compliance with standard operating procedures (SOPs) and method requirements. If non-conformances exist, the published method serves as the standard for compliance. SOPs are edited for compliance if the document does not reflect method requirements. Analysts are trained to the new requirements and the process is monitored by quality assurance. Analysts are retrained in method procedures if an evaluation of bench practices indicates non-compliance with SOP requirements.

17.3 ***Documentation Audits***. Documentation audits are conducted monthly. This audit includes a check of measurement processes that require manual documentation. It also includes checks of data archiving systems and a search to find and remove any inactive versions of SOPs that may still be present in the laboratory and being accessed by the analysts. Non-conformances are corrected on the spot. Procedural modifications are implemented if the evaluation indicates a systematic defect.

17.4 ***Corrective Action Monitoring***. Defects or non-conformances that are identified during client or internal audits are corrected through process modifications and/or retraining. Once a corrective action has been designed and implemented, it is monitored for compliance on a regular basis by the QA staff. Spot corrections are performed if the staff is not following the new procedure. Monitoring of the corrective action continues until satisfactory implementation has been verified.

17.5 ***Management Reports***. Formal reports of all audit activities are prepared for the management staff. These reports are prepared quarterly. The report details the status of the Quality System

The formal report also addresses the following topics:

- Status and results of internal and external audits,
- Status and results of internal and external proficiency testing,
- Identification of quality control problems in the laboratory,
- Discussion of corrective action program issues,
- Status of external certifications and approvals,
- Status of staff training and qualifications,
- Discussion of new quality system initiatives.
- Recommendations for further action on listed items are included in the report.

Appendix I

Glossary of Terms

GLOSSARY OF TERMS

Acceptance Criteria: specified limits placed on characteristics of an item, process, or service defined in requirement documents.

Accreditation: the process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one.

Accuracy: the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator.

Analyst: the designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality.

Audit: a systematic evaluation to determine the conformance to quantitative *and qualitative* specifications of some operational function or activity.

Batch: environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A **preparation batch** is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An **analytical batch** is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Blank: a sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.

Blind Sample: a sub-sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration: to determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.

Calibration Curve: the graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response.

Calibration Method: a defined technical procedure for performing a calibration.

Calibration Standard: a substance or reference material used to calibrate an instrument.

Certified Reference Material (CRM): a reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body.

Chain of Custody: an unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples.

Clean Air Act: the enabling legislation in 42 U.S.C. 7401 *et seq.*, Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and to enforce them.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): the enabling legislation in 42 U.S.C. 9601-9675 *et seq.*, as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601*et seq.*, to eliminate the health and environmental threats posed by hazardous waste sites.

Confirmation: verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to second column confirmation, alternate wavelength, derivatization, mass spectral , interpretation, alternative detectors or, additional cleanup procedures.

Conformance: an affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements.

Corrective Action: the action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence.

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality (i.e., that they meet specified acceptance criteria).

Data Reduction: the process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form.

Demonstration of Capability: a procedure to establish the ability of the analyst to generate acceptable accuracy.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Duplicate Analyses: the analyses or measurements of the variable of interest performed identically on two sub-samples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory.

Federal Water Pollution Control Act (Clean Water Act, CWA): the enabling legislation under 33 U.S.C. 1251 *et seq*., Public Law 92-50086 Stat. 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance.

Field of Testing: NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff).

Holding Times (Maximum Allowable Holding Times) the maximum times that samples may be held prior to analysis and still be considered valid or not compromised.

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample): a sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes from a source independent of the calibration standards or a material containing known and verified amounts of analytes. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Matrix: the component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated a potable or potential potable water source. Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake. Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device.

Matrix Spike (spiked sample or fortified sample): a sample prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of Target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix Spike Duplicate (spiked sample or fortified sample duplicate): a second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Method Blank: a sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest, which is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.

Method Detection Limit: the minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

National Institute of Standards and Technology (NIST): an agency of the US Department of Commerce's Technology Administration that is working with EPA, States, NELAC, and other public and commercial entities to establish a system under which private sector companies and interested States can be accredited by NIST to provide NIST-traceable proficiency testing (PT) to those laboratories testing drinking water and wastewater.

National Environmental Laboratory Accreditation Conference (NELAC): a voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP.

National Environmental Laboratory Accreditation Program (NELAP): the overall National Environmental Laboratory Accreditation Program of which NELAC is a part.

NELAC Standards: the plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference.

Performance Audit: the routine comparison of independently obtained *qualitative and* quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory.

Precision: the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.

Preservation: refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.

PT Fields of Testing: NELAC's approach to offering proficiency testing by regulatory or environmental program, matrix type, and analyte.

Proficiency Testing: a means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.

Proficiency Test Sample (PT): a sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria.

Quality Assurance: an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Control: the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Manual: a document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.

Quantitation Limits: the maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user.

Range: the difference between the minimum and the maximum of a set of values.

Raw Data: any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g., tapes which have been transcribed verbatim, data and verified accurate by signature), the exact copy or exact transcript may be submitted.

Reagent Blank (method reagent blank or method blank): a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps.

Reference Material: a material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.

Reference Method: a method of known and documented accuracy and precision issued by an organization recognized as competent to do so.

Reference Standard: a standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.

Replicate Analyses: the measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval.

Requirement:. denotes a mandatory specification; often designated by the term "shall".

Resource Conservation and Recovery Act (RCRA): the enabling legislation under 42 USC 321 *et seq.* (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal.

Safe Drinking Water Act (SDWA): the enabling legislation, 42 USC 300f *et seq.* (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations.

Sample Duplicate: two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis.

Spike: a known mass of target analyte added to a blank sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

Standard: the document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies.

Toxic Substances Control Act (TSCA): the enabling legislation in 15 USC 2601 *et seq.*, (1976), that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture.

Traceability: the property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons.

United States Environmental Protection Agency (EPA): the federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends.

Validation: the process of substantiating specified performance criteria.

Verification: confirmation by examination and provision of evidence that specified requirements have been met.
NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

APPENDIX C

SITE SAFETY AND HEALTH PLAN

SITE SAFETY AND HEALTH PLAN
LAKE CONESTEE SITE
GREENVILLE COUNTY, SOUTH CAROLINA

Prepared for:

United States Army Corps of Engineers-Charleston District
Charleston, South Carolina

Prepared by:

S&ME, Inc./Pinnacle Consulting Group
Spartanburg, South Carolina/Greenville, South Carolina

August 2002

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1.0 INTRODUCTION

This section of the Site Safety and Health Plan (SSHP) document defines general Site setting, historical review and applicability and general responsibilities with respect to compliance with Health and Safety programs.

1.1 Site Description

Lake Conestee is located in south-central Greenville County, South Carolina in the unincorporated town of Conestee, South Carolina (Figures 1, 2, and 3) approximately seven miles south of the city of Greenville, South Carolina. The site coordinates (using the Lake Conestee dam as the reference location) are 34° 46' 12" north latitude and 82° 20' 56" west longitude. The 144.97-acre site was recently purchased from Mr. H.J. Brand (Conestee, South Carolina) by a non-profit organization, The Conestee Foundation. The site is currently zoned I-1 (Light Industrial). The Reedy River bisects the property, and the lake is estimated to be volumetrically over 95% silted-in.

1.2 Site History

(See Work Plan, Section 2.1)

1.3 Scope and Applicability of the SSHP

The purpose of this SSHP is to define the requirements and designate protocols to be followed at the Site during investigation activities. Applicability extends to all Zapata Engineering, Pinnacle, and S&ME employees, contractors, subcontractors, and visitors.

All personnel on the Site, contractors and subcontractors included, shall be informed of the Site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation.

This plan must be reviewed and an agreement to comply with the requirements must be signed by all personnel prior to entering the exclusion zone or the contamination reduction zone.

During development of this plan, consideration was given to current safety standards as defined by the Occupational Safety and Health Administration (OSHA) and other applicable agencies. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR 1910 Standards

- NIOSH/OSHA/USCG/EPA Occupational Health and Safety Guidelines
- American Conference of Governmental Hygienists (ACGIH) Threshold Limit Values

1.4 Visitors

As a general rule, visitors will not be allowed to enter the contamination reduction and exclusion zones. The HSO and Site Manager may approve visitors with a specific need to enter these work areas. All visitors entering the contamination reduction and exclusion zones at the Site will be briefed by the HSO on the provisions of this SSHP. In addition, visitors will be expected to show documentation of compliance with relevant OSHA requirements such as medical monitoring, training, and respiratory protection (if applicable). Visitors will also be expected to provide their own protective equipment.

In the event that a visitor does not adhere to the provisions of the SSHP, he/she will be requested to leave the work area. All non-conformance incidents will be recorded in the site log.

2.0 PROJECT OBJECTIVES AND ORGANIZATION

2.1 Project Objectives

The overall project objective is to collect sediment, surface water, fish tissue, and soil samples as described in the Work Plan.

2.2 Key Personnel

The following personnel and organizations are critical to the planned activities at the Site. The organizational structure will be reviewed and updated, as needed.

Project Managers:	~~Greg Hippert (Zapata)~~	~~(704) 358-8240~~
	Jerry Wylie (Pinnacle)	(864) 467-0811
Site Manager:	Bradley Kuntz (Zapata)	(704) 358-8240
Site HSO Coordinator:	Bradley Kuntz (Zapata)	(704) 358-8240
Project CIH	Sherman Woodson (S&ME)	(864) 574-2360
Corporate Health and Safety Coordinator:	Dan Caton (S&ME)	(919) 872-2660
Plan Preparer:	Sherman Woodson (S&ME)	(864)574-2360
Plan Reviewer:	Jerry Wylie (Pinnacle)	(864) 467-0811
Preparation Date:	August 9, 2002	

2.3 Site Specific Health and Safety Personnel

The Site Health and Safety Officer (HSO) has total responsibility for ensuring that the provisions of this SSHP are adequate and implemented in the field. The HSO is also responsible for conducting Site inspections on a regular basis in order to ensure the effectiveness of this plan. The HSO at the Site is Bradley Kuntz.

The Project Certified Industrial Hygienist will assist the HSO in implementing the provisions of this SSHP and modifying these provisions as field conditions change. The Project CIH will review air monitoring results to ensure that control methods and Personal Protective Equipment (PPE) are adequate. The Project CIH is Sherman Woodson.

2.4 Project Manager (Zapata/Pinnacle/S&ME)

The Project Manager (PM) shall direct operations on the Site. The PM may delegate all or part of these duties to a properly-qualified Zapata/Pinnacle/S&ME employee who is designated as the Site Manager. At the Site, the PM, assisted by the HSO, has primary responsibility for the following tasks.

1. Seeing that appropriate personal protective equipment and monitoring equipment is available and properly utilized by all Zapata/Pinnacle/S&ME personnel on the Site.

2. Establishing that Zapata/Pinnacle/S&ME personnel are aware of the provisions of this plan, are instructed in the work practices necessary to ensure safety, and are familiar with planned procedures for dealing with emergencies.

3. Establishing that all Zapata/Pinnacle/S&ME personnel on the Site have completed a minimum of 40 hours of health and safety training and have appropriate medical clearance as required by 29 CFR 1910.120, and have been fit tested for the appropriate respirators.

4. Seeing that Zapata/Pinnacle/S&ME personnel are aware of the potential hazards associated with Site operations.

5. Monitoring the safety performance of all Zapata/Pinnacle/S&ME personnel to see that the required work practices are employed.

6. Correction of any Zapata/Pinnacle/S&ME work practices or conditions that may result in injury or exposure to hazardous substances.

7. Preparing any accident/incident report for Zapata/Pinnacle/S&ME activities.

8. Halting Zapata/Pinnacle/S&ME site operations, if necessary, in the event of an emergency or to correct unsafe work practices.

9. Reviewing and approving this project Health and Safety Plan.

2.5 Site Health and Safety Officer (Zapata/Pinnacle/S&ME)

The Site Health and Safety Officer's (HSO) duties may be carried out by the PM or other Zapata/Pinnacle/S&ME Site manager. The HSO, unless specifically directed by this SSHP, does not offer or otherwise provide health and safety guidance to any subcontractor unless there is an imminent endangerment to personnel, in which case guidance is to be directed to the Subcontractor Safety Representative (SSR) only.

The duties of the HSO are as follows.

1. Implements project Health and Safety Plans, and reports any deviations from the anticipated conditions described in the plan to the PM, and the Project CIH.

2. Determines that monitoring equipment is used properly by Zapata/Pinnacle/S&ME personnel and is calibrated in accordance with manufacturer's instructions or other standards, and that results are properly recorded and filed.

3. Ensures that assigned Zapata/Pinnacle/S&ME personnel have current Fit-For-Duty medical and training authorizations.

4. Assumes any other duties as directed by the PM.

5. Identifies all Zapata/Pinnacle/S&ME personnel with special medical problems (e.g., allergies, perforated eardrum, etc.).

6. Conducts daily safety meetings and completes the Site Safety Meetings log (Appendix A).

7. Provides ongoing review of the protection level needs as project work is performed, and informs the PM of the need to upgrade/downgrade protection levels as appropriate.

8. Sees that decontamination procedures listed in Section 8.0 are followed by Zapata/Pinnacle/S&ME personnel.

9. Establishes monitoring of Zapata/Pinnacle/S&ME personnel and records results of exposure evaluations.

10. Halting Zapata/Pinnacle/S&ME Site operations, if necessary, in the event of an emergency or to correct unsafe work practices.

11. Reviews and approves this project health and safety plan.

2.6 Corporate Health and Safety Manager (S&ME)

The Corporate Health and Safety Manager (CHSM) shall perform the following tasks.

1. Determine the need for periodic audits of the operation to evaluate

compliance with this plan.

2. Provide health and safety support as requested by the HSO and PM.

2.7 Project Personnel (Zapata/Pinnacle/S&ME)

Project personnel involved in investigations on the Site and operations are responsible for:

1. Taking all reasonable precautions to prevent injury to themselves and to their fellow employees.

2. Performing only those tasks that they believe they can do safely, and immediately reporting any accidents and/or unsafe conditions to the HSO or PM for action.

3. Notifying the PM and HSO of any special medical problems (i.e., allergies) and seeing that all Zapata/Pinnacle/S&ME personnel on the Site are aware of any such problems.

4. Reviews project health and safety plan and signs Certification of Site Personnel form (Appendix B).

2.8 Subcontractor's Safety Representative

Each subcontractor is requested to designate a Subcontractor's Safety Representative (SSR), who is the subcontractor supervisor. The SSR is responsible for the safe and healthful performance of work by his work force and subcontractors. During the subcontractor's activities on the Site, the SSR will perform continuing work area inspections, and conduct safety meetings and safety orientations for all new employees. The SSR will attend periodic safety meetings with the SSO. The SSR will also investigate accidents and overexposure involving subcontractor personnel.

2.9 Subcontractor Personnel

Zapata/Pinnacle/S&ME will insist on the following health and safety requirements from its subcontractors:

- Subcontractor employees must have appropriate training (i.e., either a 40-hour or 24-hour OSHA required (29 CRF 1910.120) health and safety course for hazardous waste work, or certified equivalent training).

- Personnel working at hazardous waste sites must have had an annual physical (or physician's waiver for biennial physical) and be certified "fit for duty" and "fit for respirator use," if necessary, by a qualified physician.

- Zapata/Pinnacle/S&ME will insist on obtaining proof of both training and a physical before site work may begin.

- Personnel must have appropriate personal protective equipment (PPE) for the specific job. At a minimum, personnel should have the following equipment:

  - Hard hat
  - Safety shoes
  - Gloves
  - Goggles/safety glasses
  - Hearing protection, if appropriate
  - Respiratory protection, if appropriate (with fit test)
  - Other equipment as specified by the SSHP.

- Excavation equipment and field operations must meet applicable safety standards and satisfy Zapata/Pinnacle/S&ME's field inspection. Unsafe equipment or operations will necessitate shut down of the job at a cost to the subcontractor.

The subcontractor will provide at least minimum safety equipment as required by the site-specific SSHP. When respirators are necessary, the subcontractor will provide a respirator fit test certificate and a physician's "fit for respirator use" declaration.

3.0 SITE ENTRY REQUIREMENTS

Prior to entering the Site, all personnel (Zapata/Pinnacle/S&ME and Subcontractor) must provide documentation of adequate training and current enrollment in an approved medical monitoring program. These requirements are discussed below.

3.1 Personnel Training Requirements

Consistent with OSHA's 29 CFR 1910.120 regulation covering Hazardous Waste Operations and Emergency Response, all site personnel are required to be trained in accordance with the standard. At a minimum all personnel are required to be trained to recognize the hazards on the Site, the provisions of this SSHP, and the responsible personnel.

Prior to arrival on the Site, each employer will be responsible for certifying that his/her employees meet the requirements of pre-assignment training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3). The employer should be able to provide a document certifying that each general site worker has received 40 hours of instruction off the Site, and 24 hours of training for any workers who are on the Site only occasionally for a specific task. All personnel must also receive 8 hours of refresher training annually.

Consistent with OSHA 29 CFR 1910.120 paragraph(e) (8), individuals designated as site supervisors require an additional 8 hours of training.

The following individuals are identified as site supervisors:

Name	Title/Responsibility
Bradley Kuntz	Field Operations Manager/Site HSO
Greg Hippert	Zapata Project Manager
Jerry Wylie	Pinnacle Project Manager

3.2 Medical Surveillance Requirements

Medical monitoring programs are designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions prior to potential exposures. The medical surveillance program is a part of each employers Health and Safety program.

Baseline or Pre-assignment Monitoring

Prior to being assigned to a hazardous or a potentially hazardous activity involving exposure to toxic materials, an employee must receive a pre-assignment or baseline physical. The contents of the physical are to be determined by the employer's medical consultant.

The pre-assignment physical should categorize employees as fit-for-duty and able to wear respiratory protection.

Periodic Monitoring

In addition to a baseline physical, all employees require a periodic physical within the last 12 months unless the advising physician believes a shorter interval is appropriate. The employer's medical consultant should prescribe adequate minimum medical monitoring which fulfills OSHA 29 CFR 1910.120 requirements.

All personnel working in contaminated or potentially contaminated areas at the Site will verify currency (within 12 months) with respect to medical monitoring. This is done by indicating the date of the last physical on the safety plan agreement form.

Exposure/Injury/Medical Support

As a follow-up to an injury or possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow-up testing within 24-48 hours. It will be up to the employer's medical consultant to advise the type of test required to accurately monitor for exposure effects.

Exit Physical

At termination of employment or reassignment to an activity or location which does not represent a risk of exposure to hazardous substances, an employee shall require an exit physical. If his/her last physical was within the last 6 months, the advising medical consultant has the right to determine adequacy and necessity of exit exam.

4.0 SITE ORGANIZATION AND COMMUNICATIONS

This section will describe how the Site will be organized with respect to the different levels of support and the various means of communication that will be utilized.

4.1 Site Organization

Three different work levels or zones will be established for this project. They are the support zone, the contamination reduction zone, and the exclusion zone.

Support Zone: This area will be designated for overall sight support and will not require the use of personal protective equipment (PPE). The support zone will be located in the prevailing up-wind direct from the contamination reduction and exclusion zone. All records on the Site will be maintained in this area as well as outside communications. Because of the anticipated short duration of field activities, no permanent structures are planned; however, a temporary structure such as a canopy may be erected. All health and safety briefings as well as any other site meetings will be conducted in this area.

Contamination Reduction Zone: All personnel and equipment decontamination will be conducted in this area. Decontamination supplies and equipment will also be stored in this area. Entrance to this area will be controlled and require the use of PPE. In addition, decontamination fluids and disposable PPE will be stored in this area until a decision of the final disposition of these materials is made. All personnel leaving the contamination zone will be required to decontaminate themselves and any equipment that may have been used according to the posted instructions in the contamination reduction zone. The following standing orders are in effect for work in the contamination reduction zone:

STANDING ORDERS FOR CONTAMINATION REDUCTION ZONE

- No smoking, eating, or drinking in this zone.
- No horse play.
- No matches or lighters in this zone.
- Wear the appropriate level of protection.

Exclusion Zone: The exclusion zone will consist of an area approximately 25 feet around the backhoe bucket. This area will be marked with barricade tape and access controlled. No one will be allowed into this area without donning the proper PPE, which will be discussed in Section 6.0 of this SSHP. The highest anticipated concentrations of toxic and/or hazardous materials are expected in this area of the Site. The following standing orders are in effect for work in the Exclusion Zone:

STANDING ORDERS FOR EXCLUSION ZONE

- No smoking, eating, or drinking in this zone.
- No horse play.
- No matches or lighters in this zone.
- Check-in on entrance to this zone.
- Check-out on exit from this zone.
- Implement the communications system.
- Line of sight must be in position.
- Wear the appropriate level of protection.

4.2 On-site Communications

Successful communications between field teams and contact with personnel in the support zone is essential. Outside communications via a cellular telephone will be maintained in the support zone.

5.0 SITE OPERATIONS AND HAZARDS

Described in this section are the planned operations and associated hazards that are anticipated at this Site. During execution of the Work Plan, additional hazards may be identified. These hazards will be addressed in the field and documented as attachments to the plan.

5.1 Chemical Hazards

Previous sampling results indicate low concentrations of metals, pesticides, PCB's, and semi-volatiles are present in surface water and sediment. The concentrations that have been detected are unlikely to result in a hazard by inhalation. Employees will be protected from direct skin contact during collection of surface water, soil, and sediment samples. Secondary ingestion will be prevented by the use of proper decontamination procedures prior to breaks and at the end of sampling activities.

5.2 Operational Hazards

The following tasks are expected to be undertaken at this Site:

- Soil, Sediment, Surface Water, and Fish Sampling
- Equipment Decontamination

Hazards associated with sample collection include:

- Falling out of the boat into the lake;
- Possible exposure to hazardous chemicals;
- Insect bites; and
- Heat or cold stress.

HAZARD PREVENTION

- Comply with the PPE requirements as stated in this <u>SSHP</u>.

- Wear life jackets when sampling in boat.

- After completing personal decontamination, thoroughly check yourself for ticks and other insects. Keep first aid kit near sampling location.

- During warm weather, drink sufficient fluids and adjust work/rest schedule, if necessary.

- During cold weather, wear warm, layered clothing. If clothing becomes wet, change into dry clothes.

6.0 PERSONAL PROTECTIVE EQUIPMENT TO BE USED

6.1 Levels of Protection

The tasks for this project will require that employees use Level D protection. The required PPE for each level of protection is described below. The anticipated level of protection has been selected based on the potential for skin contact with soil/liquids and concentrations of dust/vapors in the air. Section 6.3 lists the anticipated levels of protection for each task.

Level D Personnel Protective Equipment:

- Inner Gloves (vinyl);
- Boots, steel toe;
- Life jacket (for sample collection from the boat); and
- Chemical-protective coveralls, face shield, and nitrile gloves (if sample collection may result in skin contact or splash).

6.2 Reassessment of Protection Program

The Level of Protection provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions or findings of investigations.

When a significant change occurs, the hazards should be reassessed. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as work that begins on a different portion of the Site.
- Change in job tasks during a work phase.
- Change of season/weather.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.
- Contaminants other than those previously identified are encountered.
- Change in ambient levels of contaminants.

- Change in work scope which effects the degree of contact with contaminants.
- Capacity of personnel to work in PPE.

6.3 Site Specific Levels of Personal Protection

The majority of the tasks on site will be conducted in Level D, as described above. If personnel have a potential for splash from liquids, Saranex coveralls and a face shield will be worn. The table below indicates the anticipated levels of protection. Tasks with more than one level selected (D/C) indicate a potential for upgrade based on site-specific monitoring.

Task	Level of Protection
Sample collection	D

7.0 SITE SPECIFIC AIR MONITORING

Site-specific air monitoring will not be required for the tasks that will be performed during this project. The sample collection is not anticipated to disturb materials in a manner that will create potential exposures to employees.

8.0 DECONTAMINATION PLAN

Decontamination of personnel and equipment is the orderly removal of contaminants and contaminated PPE. As previously stated, decontamination is completed in a lower level of personal protection than that used in the exclusion zone.

This decontamination plan will present the sequence of decontamination to take place at the Site. Decontamination during other tasks will be discussed in general terms.

Site personnel must wash face and hands prior to eating and drinking on site. As soon as possible after completing site tasks, personnel will shower.

9.0 EMERGENCY RESPONSE/CONTINGENCY PLAN

In the event of an on-site emergency, it will be very important that each member on the site team understands the following emergency procedures. The SSO will be in charge of assessing the situation and directing other members of the site team. This emergency response plan is compatible with local, state and federal disaster and emergency management plans as appropriate.

9.1 Pre-Emergency Planning

During daily site briefings, all employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes. The plan will be reviewed and revised if necessary, on a regular basis by the HSO. This will ensure that the plan is adequate and consistent with prevailing site conditions.

9.2 Personnel Roles and Lines of Authority

The Site Safety Officer has primary responsibility for responding to and correcting emergency situations. This includes taking appropriate measure to ensure the safety of site personnel and the public. Possible actions may involve evacuation of personnel from the site area, and evacuation of adjacent tenants. He/she is additionally responsible for ensuring that corrective measures have been implemented, appropriate authorities notified, and follow-up reports completed. The HSO may be called upon to act on the behalf of the site supervisor, and will direct responses to any medical emergency. The individual contractor organizations are responsible for assisting the project manager in his/her mission within the parameters of their scope of work.

9.3 Evacuation Routes/Procedures

In the event of an emergency that necessitates an evacuation of the Site, the following alarm procedures will be implemented:

Three short blasts on the air horn will be sounded. All on-site personnel should stop their activity and immediately move toward the rally point. The rally point will be established at the initial site health and safety meeting in the prevailing up-wind direction from the exclusion zone. Potentially contaminated personnel should segregate themselves from non-contaminated personnel until decontamination occurs.

9.4 Local Sources of Assistance

The following list provides names and telephone numbers for emergency contact personnel. In the event of a medical emergency, personnel will take direction from the SSO and notify the appropriate emergency organization. In the event of a fire or spill, the site supervisor will notify the appropriate local, state, and federal agencies.

Organization	Contact	Telephone
Ambulance:	Greenville County Emergency Services	911

Police:	Greenville County Sheriff's Office 4 McGee Street Greenville, SC	911
Hospital:	Greenville Hospital System 701 Grove Road Greenville, SC	864-455-7000
Poison Control Center		800-922-1117
SCDHEC		803-734-5200
Chemtrec		800-424-9555

9.5 Emergency Medical Treatment Procedures

Any person who becomes ill or injured in the exclusion zone must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.) First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the project manager.

Any person being transported to a clinic or hospital for treatment should take with them information on the chemical(s) they have been exposed to at the Site.

Any vehicle used to transport contaminated personnel will be treated and cleaned as necessary.

9.6 Fire or Explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the project manager or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on the Site.

If it is safe to do so, site personnel may:

- Use fire fighting equipment available on the Site to control or extinguish the fire; and,

- Remove or isolate flammable or other hazardous materials which may contribute to the fire.

9.7 Spill or Leaks

In the event of a spill or a leak, site personnel will:

- Inform their supervisor immediately
- Locate the source of the spillage and stop the flow if it can be done safely
- Begin containment and recovery of the spilled materials.

9.8 Emergency Equipment/Facilities

The following emergency equipment will be available at the supervisor's company truck:

- First aid kit
- Fire extinguisher
- Mobile telephone

10.0 APPROVALS

Plan Preparer:

Sherman Woodson, CIH, CSP

Site Safety Officer:

Project Manager:

Jerry A.Wylie, P.G.

This Health and Safety Plan is valid only for this specific project. It is not to be used for other projects or subsequent phases of this project without the written approval of the Corporate Health and Safety Manager.

APPENDIX A

SITE SAFETY MEETINGS

APPENDIX A SITE SAFETY MEETINGS

Site Safety Meetings will be held at regular intervals, including at the beginning of site activities and at the beginning of each day's activities. Personnel in attendance at each meeting must sign and date the Site Safety Meeting Attendance Roster.

Meeting Date: ______________________________

Meeting Topic: ______________________________

Presenter: ______________________________

SIGNATURE	DATE
______________________	______________
______________________	______________
______________________	______________
______________________	______________
______________________	______________
______________________	______________

Meeting Date: ______________________________

Meeting Topic: ______________________________

Presenter: ______________________________

SIGNATURE	DATE
______________________	______________
______________________	______________
______________________	______________
______________________	______________
______________________	______________
______________________	______________

APPENDIX A SITE SAFETY MEETINGS (continued)

Site Safety Meetings will be held at regular intervals, including at the beginning of site activities and at the beginning of each day's activities. Personnel in attendance at each meeting must sign and date the Site Safety Meeting Attendance Roster.

Meeting Date: ______________________________

Meeting Topic: ______________________________

Presenter: ______________________________

SIGNATURE	DATE

Meeting Date: ______________________________

Meeting Topic: ______________________________

Presenter: ______________________________

SIGNATURE	DATE

APPENDIX B

CERTIFICATION OF SITE PERSONNEL

APPENDIX B CERTIFICATION OF SITE PERSONNEL

By signing below, I certify that I have read this Health & Safety Plan and am familiar with its provisions and my own proposed activities and responsibilities on site.

NAME (Signed)	DATE

APPENDIX C

TOXICITY SUMMARY

Chlorodiphenyls and Derivatives

(Chlorodiphenyls, polychlorinated biphenyl, PCB)

Industrial Uses: Chlorodiphenyls are used in the manufacture of hydraulic fluids and lubricants, and as plasticizers for cellulosics, vinyl resins, and crude rubber.

Exposure Limits:

TLV: 0.5 mg/m^3 TWA (54% chlorine), Skin, Animal Carcinogen; 1 mg/m^3 TWA (42% chlorine), Skin

PEL: 0.5 mg/m^3 TWA (54% chlorine), Skin; 1 mg/m^3 TWA (42% chlorine), Skin

IDLH: 5 mg/m^3 Carcinogen

Physical Data:

Description:	Colorless to pale yellow, viscous liquid or solid (below 50° F) with a mild, hydrocarbon odor
Solubility:	Miscible in alcohol and ether, insoluble in water
Incompatibilities:	Strong oxidizers, acids, and alkalies
Boiling Point:	689 – 734 °F
Melting Point:	N/A
Vapor Pressure:	0.00006 mm Hg @ 68°F
Vapor Density:	8.9 – 11.2
Ionization Potential:	N/A
Flammability:	Nonflammable liquid
LEL:	N/A
UEL:	N/A
Respirator Cartridge Breakthrough Time:	N/A
Hnu Sensitivity:	N/A
OVA Sensitivity:	N/A

Human Toxicity:

Systemic Effects:	Inhalation:	Produces irritation of the skin; irritation and swelling of the eyes
	Ingestion:	Produces liver damage
	External Contact:	Causes chloracne
Carcinogenic Effects:		NIOSH Carcinogen

DRAFT – WORK PLAN ADDENDUM

Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee – Greenville, South Carolina

Prepared for:
US Army Corps of Engineers-Charleston District
Charleston, South Carolina

Prepared by:
Zapata Engineering/Pinnacle Consulting Group
Charlotte, North Carolina/Greenville, South Carolina

August 9, 2002

DRAFT - Work Plan Addendum

Targeted Brownfields Assessment Follow-Up Investigation
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Prepared for:
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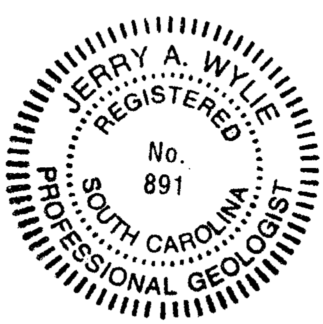
Charlotte, NC/Greenville, SC

Submitted
August 9, 2002

The information contained herein has been reviewed and interpreted as being complete to the best of my knowledge. I further attest, to the best of my knowledge, that the information has been prepared in accordance with industry standards and with the applicable regulations.

Jerry A. Wylie
South Carolina Professional Geologist #891

Aug 09 2002
Date



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List of Acronyms

ARARs	applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COC	contaminants-of-concern
DQO	data quality objectives
FSAP	Field Sampling and Analysis Plan
GPS	Global Positioning System
IDW	investigation derived waste
msl	mean sea level
NCP	National Contingency Plan
PAH	polyaromatic hydrocarbons
PCB	polychlorinated biphenyls
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
SCDHEC	South Carolina Department of Health and Environmental Control
SSHP	Site Safety and Health Plan
SVOC	semi-volatile organic compounds
TAL	Target Analyte List
TBA	Targeted Brownfields Assessment
TCL	Target Compound List
USACE	United States Army Corps of Engineers
US EPA	United Stated Environmental Protection Agency
VOC	volatile organic compound
WCRSA	Western Carolina Regional Sewer Authority

DRAFT WORK PLAN DOCUMENT DEVELOPMENT NOTES

Much of the information, procedures, and methods developed for the initial phase Targeted Brownfields Assessment are relevant to and will be used in the implementation of the follow-up investigation. As such, this Addendum has been developed to include the original Work Plan and most of its elements. New information, procedures, and methods have been added to the original Work Plan, as appropriate, to reflect the scope of work for the follow-up investigation. Text/information that pertained exclusively to the original initial investigation (e.g., assessment locations) have been deleted. Revised or new material has been designated using the "track changes" feature in the word processing program and is indicated by underlining and margin bars that indicate the text that has been added or modified. New or revised figures are indicated in the legend.

1.0 INTRODUCTION

The purpose of this Work Plan Addendum is to provide procedures for performing a follow-up investigation to the initial phase of assessment associated with the Targeted Brownfields Assessment (TBA) of the Lake Conestee property located in Greenville County, South Carolina. The initial phase of the TBA was conducted in November/December 2000. The results of the initial phase of the TBA were reported to the South Carolina Department of Health and Environmental Control (SCDHEC) in March 2001 (Pinnacle, March 8, 2001). Included in this Work Plan Addendum are updates to the Field Sampling and Analysis Plan (FSAP), Site Safety and Health Plan (SSHP), and Quality Assurance Project Plan (QAPP).

The overall objectives of the follow-up investigation are to assess releases of hazardous substances onto the property that could impact the use of the property as a community greenspace, passive recreation area, and environmental education resource. The results of this investigation will also be used in determining the need for remediation or release control measures to protect human health and the environment. Specific project objectives include:

- Determine sediment and surface water contaminant levels in areas of Lake Conestee not previously sampled;
- Determine fish tissue contaminant levels in specific areas of Lake Conestee for the purpose of supporting human health exposure assessments;
- Determine background soil contaminant levels for the purpose of estimating regional sediment contaminant levels; and
- Determine contaminant levels in surface waters and sediments that have become accessible to human exposure with the lake at full pool.

The assessment activities conducted in association with the investigation will be consistent with the intent of the National Contingency Plan (NCP), 40 Code of Federal Regulations (CFR) Part 300.68 (a – j). In addition, the Work Plan Addendum has been developed in general accordance with the guidelines presented in Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (US EPA, 1988).

A detailed description of the assessment activities is included in the Addendum to FSAP (Appendix A). Procedures utilized to maintain data precision, accuracy, and completeness and to ensure comparisons in environmental metrics/measurements are described in the Addendum to the QAPP (Appendix B). An Addendum to the SSHP, designed to protect site workers, is included as Appendix C.

2.0 SITE HISTORY AND SETTING

(Note: This entire section is reproduced from the Work Plan – Targeted Brownfields Assessment – Initial Phase (Pinnacle, November 10, 2000)).

Lake Conestee is located in south-central Greenville County, South Carolina in the unincorporated town of Conestee, South Carolina (Figures 1, 2, and 3) approximately seven miles south of the city of Greenville, South Carolina. The site coordinates (using the Lake Conestee dam as the reference location) are 34° 46' 12" north latitude and 82° 20' 56" west longitude. The 144.97-acre site was purchased from Mr. H.J. Brand (Conestee, South Carolina) by a non-profit organization, The Conestee Foundation in 2001. The site is currently zoned I-1 (Light Industrial). The Reedy River bisects the property, and the lake is estimated to be volumetrically over 95% silted-in.

2.1 SITE HISTORY

Lake Conestee was created for use as a mill pond around 1830 when a dam was constructed across the Reedy River. The dam was constructed to provide mechanical power to a mill that produced paper products. In later years, the mill produced cotton textile goods. In the late 1800's, the power plant was converted to generate hydroelectric power for Conestee Mills and the mill community. In 1892, a wastewater treatment plant was constructed by the City of Greenville at an upstream location (about two miles) on the Reedy River. Concentrated discharges to the Reedy River from this treatment plant accelerated degradation of Lake Conestee. In the mid-1920's, Conestee Mills sued the City of Greenville alleging that the discharges from the treatment plant had contaminated Lake Conestee to such a degree that the water was no longer usable by the mill. Conestee Mills won the case and a later appeal was also upheld. The original dam is believed to have been replaced in the 1880's by the current structure. At this writing, the US Army Corps of Engineers – Charleston District (USACE) is conducting design studies for certain maintenance and improvement features to the dam. This work is being performed through Section 206 of the Water Resources Development Program.

Throughout its history, Lake Conestee has been impacted from both point and non-point sources from within the 65 square mile watershed above the lake. This area includes nearly all of the City of Greenville and many of the City's older industrial areas. In addition to the deposition of impacted sediments within the lake area, there have been releases of sediments downstream of the dam. The condition of downstream sediments was assessed, to a limited extent, in the Phase I TBA (Pinnacle, March 8, 2001).

Observation of two aerial photographs, one taken in 1943 (Figure 4) and one in 1999 (Figure 5), reveals the significant changes that have occurred to Lake Conestee in the last 50-plus years. The sediment load from the Reedy River and Marrow Bone Creek (tributary to west side of the lake) has deposited large quantities of sediment sufficient to essentially fill the lake with sediment. Later, after the western part of the lake had become silted in from the sediment deposited by the Reedy River and Marrow Bone Creek, a new deltaic feature developed at the northern end of the eastern lobe of the lake. Reedy River deposition again resulted in the infilling of this area and the river meandered, cutting a new channel between the eastern and southern lobes of the lake.

The dam gate has been uncontrolled since the 1950's, and it has become progressively more dilapidated in recent years, such that the gate has often remained substantially log-jammed for years at a time. Because of this condition, it is likely that sediments have periodically been released in varying amounts to the Reedy River below the lake. In May or June 2000, the gate area, which had been plugged with debris, unclogged and released sediments downstream. As a result of the reconnection of the river to its original local base level, through the open gate orifice, the river began a rapid down-cutting action in the sediments behind the dam. Simultaneously, with the effect of dewatering the lake, the southern and eastern lobes of the lake dried up. The Reedy River eroded a "canyon" through the previously deposited lake sediments resulting in transport of lake sediments downstream through the open dam gate. The degree of incision was approximately 10 feet near the dam. Based on studies conducted by staff at the Natural Resources Conservation Service – US Department of Agriculture and sponsored by the Foothills Resource Conservation & Development Council in October 2000 and May 2001, the volume of sediments lost from the "canyon" was estimated to be approximately 90,000 cubic yards. In June 2001, these agencies installed an emergency "plug" (a timber cover) behind the orifice through the Emergency Watershed Protection Program. This temporary repair effectively stopped the catastrophic loss of sediment from the lake.

2.2 GEOLOGIC SETTING

The site is situated in the Piedmont physiographic province of South Carolina. The Piedmont province is broad and plateau-like with ground elevations that range from about 400 to 1,200 feet above mean sea level (msl). The Piedmont is cut by streams that develop a dendritic drainage pattern. Generally, major stream flow is to the southeast. The Lake Conestee site lies in the Inner Piedmont belt of the Piedmont geologic province. The Inner Piedmont belt is a northeast trending belt of igneous and metamorphic (crystalline) rocks that are collectively referred to as bedrock. The predominant rock types in the regional area are highly metamorphosed gneiss and schist intruded by igneous rock. Koch (1968) mapped Greenville County and showed the Lake Conestee area lying within a granitic gneiss complex close to the contact with a mica schist complex. Conversely, Overstreet and Bell (1965) showed the Lake Conestee area to be underlain by granite.

Typically in the Piedmont, a variable thickness of regolith extends from the ground surface and overlies the bedrock. Regolith is characterized by a mixture of unconsolidated material, including saprolite (in-place weathering byproduct of bedrock), alluvium (surface water deposits), colluvium (slope wash and other mass wasting deposits), and soil. Typically, the regolith contains both zones of saturated and unsaturated conditions; although, unconfined conditions predominate in the regolith/alluvium. Groundwater is recharged as a direct effect of precipitation and infiltration in topographically higher areas. Discharge areas are generally near streams in valley bottoms. Groundwater in the regolith is stored and transmitted through openings (pores) between soil and rock particles. Groundwater in the regolith zone supplies and recharges groundwater in the fractured bedrock. However, the residual soil and saprolite have a low permeability; therefore, they readily store considerable quantities of groundwater but release this water slowly to fractures within the underlying bedrock. In addition, a local flow system exists within the regolith often providing preferential flow paths in coarser lenses and in the remnants of geologic structural features in the weathered rock. Groundwater in the bedrock is generally restricted to the upper bedrock zone (< 200 feet below ground surface) because fractures tend to decrease in frequency and the degree of openness at depth.

3.0 PREVIOUS INVESTIGATIONS

Initial/Preliminary assessment activities, associated with the TBA of the 145-acre Lake Conestee site in Greenville County, South Carolina were completed in November/December 2000. The assessment activities included the collection and analysis of environmental samples from the Reedy River sediments downstream of the Lake Conestee dam (10 locations); sediments from Lake Conestee impounded areas, including isolated pools, sloughs, and beaver-impounded wetlands (29 locations); surface water samples from Lake Conestee, including isolated pools, sloughs, and beaver-impounded wetlands (13 locations); and surficial and subsurface sediments from two former deltaic areas in Lake Conestee (six locations). The sampled media were analyzed by the United States Environmental Protection Agency (US EPA) Contract Laboratory Program (CLP) contract laboratories for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), total metals, including hexavalent chromium, and cyanide. Detected concentrations were compared to appropriate regulatory action levels. The following findings were developed:

- Reedy River sediments downstream of the Lake Conestee dam were found to contain detectable concentrations of VOCs (five known/54 unknown), SVOCs (28 known/117 unknown), pesticides (eight), PCBs (two Aroclors), and metals (18). Regulatory levels were exceeded for 25 specific residual chemicals.

- Lake Conestee sediments were found to contain detectable concentrations of VOCs (20 known/32 unknown), SVOCs (88 known/149 unknown), pesticides (13), PCBs (three Aroclors), and metals (23). Regulatory levels were exceeded for 41 specific residual chemicals.

- Lake Conestee surface water samples were found to contain detectable concentrations of VOCs (one), SVOCs (12 known/23 unknown), and metals (19). Regulatory levels were exceeded for 11 specific residual chemicals, all metals.

- Sediments (surficial and subsurface) from former deltaic areas in Lake Conestee were found to contain detectable concentrations of VOCs (33 known/97 unknown), SVOCs (88 known/92 unknown), pesticides (six), PCBs (two Aroclors), and metals (21). Regulatory levels were exceeded for 35 specific residual chemicals.

Complete discussion and presentation of assessment activities and results, including a description of the limited 1978 SCDHEC sampling event, are presented in the Initial Targeted Brownfields Assessment Report-Lake Conestee Site Greenville County, SC (Pinnacle, March 8, 2001).

4.0 TECHNICAL APPROACH AND DATA QUALITY OBJECTIVES

As previously described, the objectives of the TBA follow-up investigation are to assess releases of hazardous substances onto the Lake Conestee property in areas that have not been previously sampled. This information will be used to assess the use of the property as a community greenspace and to assist in determining the need for remediation or release control measures to protect human health and the environment.

Assessment activities include data gathering and analysis to evaluate the nature and general extent of residual contaminants-of-concern (COCs). The data must be of sufficient quality and quantity to support subsequent site-related activities (e.g., risk assessment/evaluation, feasibility studies, etc.).

Data quality objectives (DQOs) are established to focus the data acquisition effort to meet the objectives of the investigation. Guidance for the Data Quality Objectives Process (US EPA, 2000) provides seven steps in the DQO process:

1. State the Problem
2. Identify the Decision
3. Identify Inputs to the Decision
4. Define the Boundaries of the Study
5. Develop a Decision Rule
6. Specify Tolerable Limits on Decision Errors
7. Optimize the Design

For Lake Conestee, DQOs will be based on available site knowledge and initial assessment information. DQOs will be revised as data is collected and elements are no longer relevant. DQOs will be evaluated with respect to data quality control, implications relative to the determination of the nature and extent of impact, implications relative to potential remedial alternatives, and implications relative to public health and ecology.

The following sections provide a discussion of the types and end-uses of the various data that is anticipated to be generated during the follow-up assessment activities. The anticipated sample locations (as described in the Addendum to the FSAP) and the decisions made from the resultant data are spatial in nature (i.e., data used to define the concentration of COCs in sediment). No time-dependent data variations are anticipated.

4.1 DATA NEEDS – BACKGROUND SOIL AND SEDIMENT SAMPLES

The decision developed from analysis of background soil and sediment data is to determine the concentrations of naturally-occurring metals in the regional/local soils and sediments. The nature of metals concentrations will be evaluated by analyzing samples of sediments along the Reedy River several miles upstream of Lake Conestee and soils from Taylor's Island for Target Analyte List (TAL) metals. Based on the data generated, residual chemical impacts to Lake Conestee soil and sediment will be compared to these background concentrations to assist in identifying areas of Lake Conestee that contain elevated levels of COCs in soil and sediment. This comparison data will be used (1) to develop a more detailed assessment plan, (2) in analyzing the potential for threats to human health and the environment, and/or (3) in remediation planning.

4.2 DATA NEEDS – FISH TISSUE SAMPLING

The decision developed from analysis of fish tissue is to determine the concentrations of site COCs in fish from Lake Conestee. The nature of COCs in fish tissue will be evaluated by analyzing samples for PCBs, organo-chlorine pesticides, and TAL metals. Based on the data generated, contaminant concentrations in the fish tissue will be compared to applicable standards and comparison criteria to determine whether there is a threat to human health (via ingestion of fish) and the environment. Based on this data, a determination can be made for the need for development of either a more robust assessment strategy and/or remedial action planning.

4.3 DATA NEEDS – SEDIMENT/SURFACE WATER FROM UNSAMPLED AREAS

The decision developed from analysis of sediment and surface water collected from previously unsampled locations is whether detected COCs constitute a threat to human health or the environment in two specific areas of Lake Conestee that have not been assessed (Marrow Bone Creek delta area (West Bay) and upstream lake areas). The nature of COCs in sediments and surface water will be evaluated by analyzing samples for TAL metals, VOCs, SVOCs, polyaromatic hydrocarbons (PAHs), PCBs, and organo-chlorine pesticides. Based on the data generated, residual chemical impacts to sediments and surface waters in these previously uninvestigated areas will be compared to standards derived from risk-based concentrations or chemical-specific applicable or relevant and appropriate requirements (ARARs) to determine whether there is a threat to human health and the environment. Based on this data, a determination can be made for the need for development of either a more robust assessment strategy and/or remedial action planning.

4.4 DATA NEEDS – SEDIMENT/SURFACE WATER FROM NEW EXPOSURE AREAS

The decision developed from analysis of sediment and surface water collected from newly-exposed areas is whether detected COCs constitute a threat to human health or the environment throughout the Lake Conestee now that lake is at "full pool." These "new" exposure areas are those in the near-shore environment where humans are most likely to have exposure to the sediments and surface water through fishing, wading, or other recreational activities. The nature of COCs in sediments and surface water at these locations of changed conditions will be evaluated by analyzing samples for TAL metals, PAHs, PCBs, and organo-chlorine pesticides. Based on the data generated, residual chemical impacts to sediments and surface waters in these areas of changed conditions will be compared to standards derived from risk-based concentrations or chemical-specific ARARs to determine whether there is a threat to human health and the environment. Based on this data, a determination can be made for the need for development of either a more robust assessment strategy and/or remedial action planning.

4.5 DATA NEEDS – SURVEYING

Many of the decisions to be made using data derived from the follow-up investigation activities are spatial in nature. Therefore, accurate and reproducible sample location information is important. Knowledge of the horizontal location of data points, and in some cases vertical information, is needed. Data point location information will be collected using Global Positioning System (GPS) equipment with an accuracy of +/- 10 feet.

4.6 CHEMICAL ANALYSES

Results of chemical analyses will be compared to standards derived from risk-based concentrations or chemical-specific ARARs to determine whether there is a threat to human health and the environment. The following considerations will be used relative to chemical analyses:

- Analytical procedures consistent with DQO Level III, as described in US EPA's Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846 (US EPA, 1992), will be utilized.
- Samples will be analyzed for parameters as described above and in the FSAP.
- Specific quality assurance/quality control (QA/QC) requirements are defined in the QAPP.

5.0 FOLLOW-UP INVESTIGATION TASKS

The work activities to be performed during the follow-up investigation are outlined in this section. Field sample collection techniques and procedures are included in the Addendum to the FSAP. Analytical information and information concerning the QA/QC process is included in the Addendum to the QAPP.

5.1 FIELD INVESTIGATION

The methods employed in the follow-up investigation have been designed to meet the established DQOs. This section generally describes the methods for continuing the investigation of the nature and extent of residual chemical impact to the soils, sediments, and surface waters of Lake Conestee. Investigation procedures are presented in Appendix B – Addendum to the FSAP. Based on the data derived from this follow-up investigation, a more detailed assessment strategy will be developed or remedial action planning will be initiated.

5.1.1 Background Soil and Sediment Sampling

Surficial soil samples and shallow sediments will be collected as a means of quantifying naturally-occurring concentrations of metals from sediments and surficial soils within the watershed. Three surficial soil samples, collected from 6 to 12 inches in depth, will be taken from Taylor's Island from areas of the former island above historic inundation elevation. Three sediment samples will be collected from natural sediment accumulation environments miles upstream of Lake Conestee. The proposed sediment sample locations have been preliminarily selected to provide information about sediments deposited under different conditions along the watershed. Collected samples will be analyzed for TAL metals. Proposed background sediment sample locations are indicated on Figure 6. The rationale for each location is discussed below:

- Sample #1 to be collected from the headwaters reach of the Reedy River in the Travelers Rest, SC area. This reach is upstream of the City of Greenville and upstream of the impacts of the lagoons and contamination associated with former industrial activities at the Renfrew site and other industrial sites through the City. This location will provide reference data for sediment unimpacted by activities in/around the City of Greenville.

- Sample #2 to be collected upstream of the city of Greenville below the confluence with Langston Creek. This location will provide reference data for sediment unimpacted by activities in/around the City but downstream of human and industrial activities in the northern portion of the watershed.

- Sample #3 to be collected upstream of the Western Carolina Regional Sewer Authority (WCRSA) discharge into the Reedy River but downstream of the City of Greenville. This location will provide reference data for sediment impacted by activities in the City but unimpacted from WCRSA's discharge.

5.1.2 Fish Tissue Sampling

Ten fish will be collected from various habitats in Lake Conestee (Figure 7). Fish will be collected from the various locations around the Lake Conestee site where fishing activities are common and have been observed. The fish will be collected using a backpack electroshocking device by a licensed fisheries biologist qualified to perform these tasks. The fish tissue samples (fillets) will be analyzed for PCBs, organo-chlorine pesticides, and TAL metals to determine the presence, absence, and degree of contaminant concentrations in Lake Conestee fish. The number of fish to be collected from each habitat is based on a distribution of the 10 allotted samples relative to the size of the habitat:

- 3 fish will be sampled from the east bay;
- 2 fish will be sampled from the south bay;
- 3 fish will be sampled from representative locations along the Reedy River channel as it courses through Lake Conestee; and
- 2 fish will be sampled from the beaver-impounded waters of the west bay and Marrow Bone Creek.

5.1.3 Sediment/Surface Water Samples from Unsampled Areas

Sediment and surface water samples will be collected from two areas that were not sampled during the initial TBA assessment: (1) the west bay/Marrow Bone Creek delta area and (2) upstream areas of the lake (Figure 8). The assessment locations may be accessed by both/either boat and by foot. The sediment samples (surface to 24 inches with the top 6 inches discarded) will be collected using a sediment coring device (discussed in the Addendum to the FSAP), and the surface water samples will be collected directly into the sampling containers (unpreserved bottleware) or decanted from a precleaned, location-dedicated container into the bottleware containing preservative.

West Bay/Marrow Bone Creek Delta Area: Fifteen shallow sediment samples and five surface water samples will be collected from this area. A sediment sample will be collected at each of the five surface water sample locations. Both the sediment samples and the surface water samples will be analyzed for TAL metals, PCBs, organo-chlorine pesticides, and PAHs. VOC and SVOC analysis will be conducted on 20% (3 sediment and 1 surface water) of the samples.

Upstream Lake Areas: Ten shallow sediment samples and five surface water samples will be collected from this area. A sediment sample will be collected at each of the five surface water sample locations. Both the sediment samples and the surface water samples will be analyzed for TAL metals, PCBs, organo-chlorine pesticides, and PAHs. VOC and SVOC analysis will be conducted on 20% (2 sediment and 1 surface water) of the samples.

Due to the inherent difficulty in accessing the areas and the continually changing landscape of the target areas, the exact sample collection locations will be selected in the field based on the following priorities: (1) collecting samples from representative environs (e.g., beaver impounded areas, Marrow Bone Creek, former creek discharge/delta areas, cut-off meanders/sloughs, areas of high-water inundation, etc.) and (2) collecting samples at specific locations to ensure adequate spatial coverage across the West Bay/Marrow Bone Creek area and the Upstream Lake area.

5.1.4 Sediment/Surface Water from New Exposure Areas

Sediment and surface water samples will be collected from randomly selected areas around the Lake Conestee site that reflect the change of site conditions caused by the repair of the dam and the return of "full pool" conditions. The assessment locations may be more safely accessed by boat or foot depending on site-specific constraints. The sediment samples (surface to 24 inches with the top 6 inches discarded) will be collected using a sediment coring device (discussed in the Addendum to the FSAP), and the surface water samples will be collected directly into the sampling containers (unpreserved bottleware) or decanted from a precleaned, location-dedicated container into the bottleware containing preservative.

Twenty-five shallow sediment samples and 10 surface water samples will be collected from these areas. A sediment sample will be collected at each of the 10 surface water sample locations. Both the sediment samples and the surface water samples will be analyzed for TAL metals, PCBs, organo-chlorine pesticides, and PAHs. The proposed locations for the samples are provided in Figure 9.

- One sediment sample and one surface water sample will be collected from the crescent-shaped slough located in the south-central portion of the site. This location will complement data collected during the initial assessment.

- Seven sediment samples and three surface water samples will be collected from the South Bay area. In general, the samples will be collected approximately 20 – 25 feet from the shoreline in the near-shoreline zone where conditions have changed since the return of the lake to full pool. The sediment samples will be collected at approximate 250-foot intervals; however, sample location selection will be finalized in the field.

- Seventeen sediment and six surface water samples will be collected from the East Bay area. In general, the samples will be collected approximately 20 – 25 feet from the shoreline in the near-shoreline zone where conditions have changed since the return of the lake to full pool. The sediment samples will be collected at approximate 250-foot intervals on the east side and approximate 500-foot intervals on the west side of the bay; however, sample location selection will be finalized in the field.

5.1.5 Investigation-Derived Waste (IDW)

Soil and sediment "cuttings"/excess resulting from the collection of samples will be discarded on-site near their source. Liquid IDW from decontamination of equipment will be collected and temporarily stored on-site. Disposal options for the liquid IDW will be determined by analyzing a sample of the liquid for TAL metals, PCBs, organo-chlorine pesticides, VOCs, and SVOCs.

5.1.6 Sample Management

Records of sample collection and shipment, analytical results, QA/QC reviews, and any other documentation will be maintained in such a way that only final and approved analytical data are used in the analysis of site conditions. DQOs for any task that involves chemical analysis will be used as the basis for determining whether the information/data is valid, valid with qualifiers, or invalid.

5.1.7 Sample Analysis Validation

Data collected during the follow-up investigation will be in accordance with the methods and protocols established in the QAPP (Section 5.0). The samples will be analyzed by SW-846 (Level III) methodologies.

5.1.8 Data Validation

Data validation procedures are discussed in the QAPP (Section 5.0).

5.2 DATA EVALUATION AND REPORTING

Evaluation of the data collected during the follow-up investigation will focus on evaluating the nature and general extent of residual COCs. The data will be used, if necessary, to design subsequent site-related activities (e.g., additional assessment, risk assessment/evaluation, feasibility studies, etc.). The data will be evaluated and a final report will be prepared and submitted that includes:

- Description of the physical characteristics and environmental setting of the site;
- Nature and extent of contamination (presence/absence, concentration, and extent of COCs in natural media); and
- Limited evaluation of contaminant fate and transport of detected contaminants to support the site conceptual model and human health/environmental evaluation.

In addition, the final report will include a limited evaluation of the potential for human health and environmental impacts at the site. This evaluation will include analysis and discussion of COCs, exposure assessment, toxicity assessment, uncertainty analysis, and a comparison of detected COC concentrations to applicable state and federal risk assessment concentrations. The final report will include details of the completed field activities, any deviations from the approved work plan procedures, maps, tabulated data, field logs, and raw data.

5.3 QUALITY ASSURANCE

The Addendum to the FSAP (Appendix A) for the follow-up investigation effort at Lake Conestee specifies the standard techniques and procedures that will be used for sampling and analysis. The Addendum to the QAPP (Appendix B) provides the procedures that will be utilized to assure that the data collected during the follow-up investigation at Lake Conestee are consistent with the specific quality goals of accuracy, precision, completeness, and representativeness. The FSAP and the QAPP have been prepared in accordance with US EPA Region IV Environmental Investigations – Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001) and EPA Guidance for Preparing Quality Assurance Project Plans (US EPA, 1998).

6.0 PROJECT MANAGEMENT

6.1 PROJECT TEAM

An organizational chart with the project team is included as Figure 10. The work elements of the follow-up investigation effort will be implemented and supervised by experienced earth sciences and engineering professionals.

David L. Hargett, Ph. D., CGWP, CPSS will serve as the overall project coordinator, Senior Consultant, and liaison with the site owner, The Conestee Foundation. In these roles, he will be a primary communication contact for all parties. In addition, he will be involved in technical aspects of the effort to ensure that the overall goals of the effort are attained. Dr. Hargett has spent hundreds of hours on Lake Conestee and has unequaled knowledge of the site. Dr. Hargett will be a primary QA/QC reviewer.

Greg Hippert will serve as the Zapata Engineering and overall project manager. In this role, he will coordinate the work elements that both Zapata and Pinnacle will implement, assist Pinnacle with the work elements for which Pinnacle will have primary responsibility, assist in and supervise the field efforts, assist with data review and evaluation, and will prepare relevant sections of the final report. Mr. Hippert will provide support for the Site Health and Safety Officer. He will be responsible for overall administrative program management, communication with the USACE, and resource allocation for Zapata.

Jerry A. Wylie, P.G. will serve as the Pinnacle Consulting Group project manager and certifying South Carolina Professional Geologist of record for the project. In this role, he will coordinate the work elements that Pinnacle will implement, assist Zapata Engineering with the work elements for which Zapata will have primary responsibility, assist in the field efforts, assist with data review and evaluation, and will coordinate submittals to the appropriate parties. Mr. Wylie will both participate in and supervise the data gathering efforts and will be on site for a representative portion of the field activities. He will be the primary writer of the final report. Mr. Wylie will be responsible for overall administrative project management and resource allocation for Pinnacle.

Bradley Kuntz will serve as the Zapata/Pinnacle field operations manager and site health and safety officer. Mr. Kuntz will be responsible for the planning and implementation of the field effort and assuring compliance of all site workers/visitors with the SSHP.

6.2 PROJECT COMMUNICATIONS

The USACE, assisted by SCDHEC and the Conestee Foundation, will be responsible for communicating with the members of the community. The Zapata/Pinnacle team will assist with communicating the technical aspects of the project and will relay information between interested parties.

6.3 DOCUMENT CONTROL

All documents (e.g., reports, correspondence, approvals etc.) prepared by Zapata/Pinnacle will be submitted to:

Mr. Dennis McKinley
US Army Corps of Engineers, Charleston District
69 Hagood Ave.
Charleston, South Carolina 29403-5107

Mr. Dana H. Leavitt, President
The Conestee Foundation
1 Marshall Court
Greenville, South Carolina 29605

6.4 PROJECT SCHEDULE

The schedule for implementation of the follow-up investigation is included as Figure 11. The schedule is a timeline of activities and milestone events associated with implementation of the assessment work.

7.0 REFERENCES

Koch, N.C., 1968. Ground Water Resources of Greenville County, South Carolina: South Carolina Geological Survey Bulletin No. 38, 82 p.

Overstreet, W.C. and H. Bell, III, 1965. Geologic Map of the Crystalline Rocks of South Carolina: United States Geological Survey Map I-413.

Pinnacle Consulting Group, November 10, 2000. Work Plan – Targeted Brownfields Assessment – Interim Phase. Lake Conestee Site – Greenville County, South Carolina.

Pinnacle Consulting Group, March 8, 2001. Initial Targeted Brownfields Assessment Report – Lake Conestee Site – Greenville County, South Carolina.

US EPA, 1987, Data Quality Objectives for Remedial Response Activities: Development Process, EPA/540/G-87-003, March 1987.

US EPA, 1988. Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, EPA/540/G-89/004, October 1988.

US EPA, 1992. Test Methods for Evaluating Solid Waste – Physical/Chemical Methods, SW-846, 3rd Edition (with updates), EPASW-846.3.4A, November 1992.

US EPA, 1998. EPA Guidance for Preparing Quality Assurance Project Plans, EPA/QA/G-5, February 1998.

US EPA, 2000. Guidance for the Data Quality Objectives Process, EPA/600/R-96/055, August 2000.

US EPA, 2001. Region IV Environmental Investigations – Standard Operating Procedures and Quality Assurance Manual, May 1996, Revised 2001.

US EPA, 2001, EPA Requirements for Quality Assurance Project Plans, EPA-QA/R-5, March 2001.

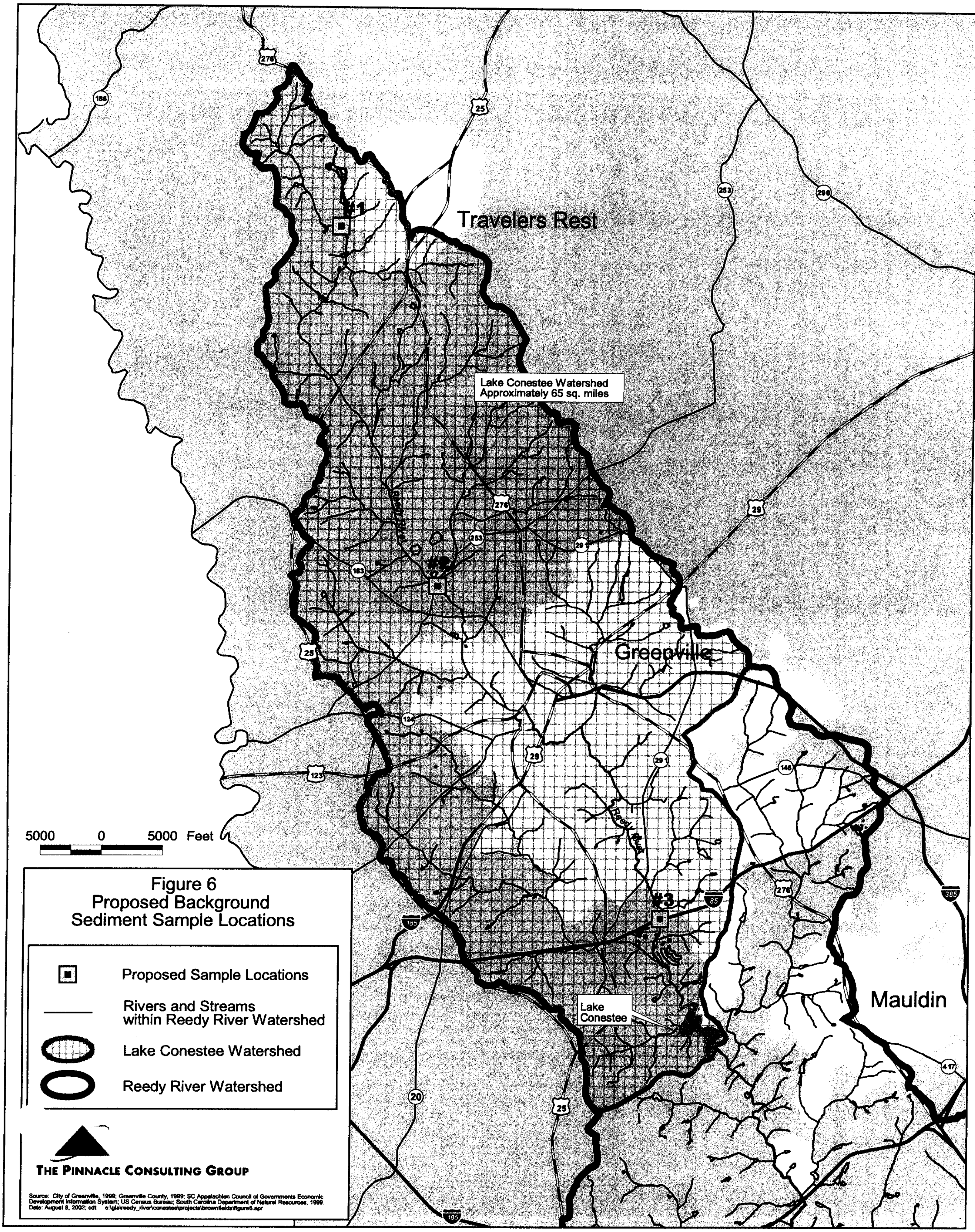


Figure 6
Proposed Background Sediment Sample Locations

Figure 9
Proposed Sediment/Surface Water Sampling Locations:
New Exposure Areas

Figure 10
Zapata/Pinnacle Project Team
Follow-Up Investigation Activities
Lake Conestee, Greenville County, South Carolina

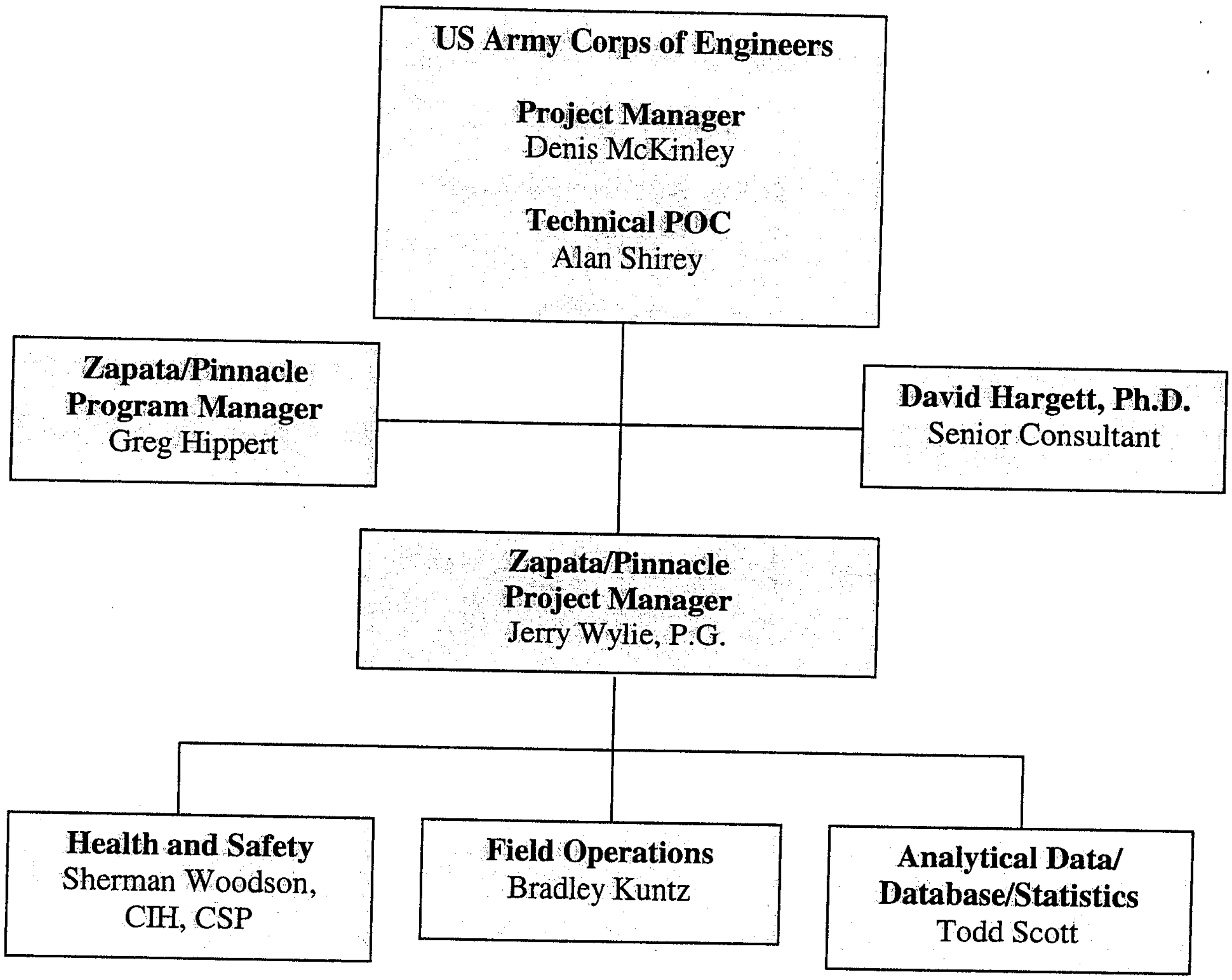


Figure 11
Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee, Greenville, South Carolina

ID	Task Name	Duration	Start	Finish
1	**Notice to Proceed**	**1 day**	**Fri 7/12/02**	**Fri 7/12/02**
2	**Workplan Addendum**	**65 days**	**Sat 7/13/02**	**Sun 9/15/02**
3	**Draft Workplan Addendum**	**30 days**	**Sat 7/13/02**	**Sun 8/11/02**
4	Develop Draft Workplan Addendum	25 days	Sat 7/13/02	Tue 8/6/02
5	Internal Review & Packaging	4 days	Wed 8/7/02	Sat 8/10/02
6	Submit Draft Workplan Addendum	1 day	Sun 8/11/02	Sun 8/11/02
7	Approve Draft Workplan Addendum	15 days	Mon 8/12/02	Mon 8/26/02
8	**Final Workplan Addendum**	**10 days**	**Tue 8/27/02**	**Thu 9/5/02**
9	Develop Final Workplan Addendum	7 days	Tue 8/27/02	Mon 9/2/02
10	Internal Review & Packaging	2 days	Tue 9/3/02	Wed 9/4/02
11	Submit Final Workplan Addendum	1 day	Thu 9/5/02	Thu 9/5/02
12	Approve Final Workplan Addendum	10 days	Fri 9/6/02	Sun 9/15/02
13	**Complete Site Assessment**	**60 days**	**Mon 9/16/02**	**Thu 11/14/02**
14	**Site Assessment Report**	**80 days**	**Fri 11/15/02**	**Sun 2/2/03**
15	**Draft Assessment Report**	**45 days**	**Fri 11/15/02**	**Sun 12/29/02**
16	Develop Draft Assessment Report	40 days	Fri 11/15/02	Tue 12/24/02
17	Internal Review & Packaging	4 days	Wed 12/25/02	Sat 12/28/02
18	Submit Draft Assessment Report	1 day	Sun 12/29/02	Sun 12/29/02
19	Approve Draft Assessment Report	15 days	Mon 12/30/02	Mon 1/13/03
20	**Final Assessment Report**	**10 days**	**Tue 1/14/03**	**Thu 1/23/03**
21	Develop Final Assessment Report	7 days	Tue 1/14/03	Mon 1/20/03
22	Internal Review	2 days	Tue 1/21/03	Wed 1/22/03
23	Submit Final Assessment Report	1 day	Thu 1/23/03	Thu 1/23/03
24	Approve Final Assessment Report	10 days	Fri 1/24/03	Sun 2/2/03

Date: 6/25/02
DACA21-02-D-0006-0001

Task	Milestone	External Tasks	
Split	Summary	External Milestone	
Progress	Project Summary	Deadline	

APPENDIX A

FIELD SAMPLING AND ANALYSIS PLAN

TABLE OF CONTENTS

Section **Page**

1.0 INTRODUCTION

This document establishes the Field Sampling and Analysis Plan (FSAP) for performing a follow-up investigation at the Lake Conestee site in Greenville, Greenville County, South Carolina. This document will be used in conjunction with the QAPP to conduct the assessment.

The purpose of the FSAP is to establish data collection activities, which are compatible with the DQOs identified in the Work Plan and to provide a mechanism for planning and approving field activities. The scope of work is intended to initially document the presence, nature, and extent of affected media. The FSAP provides guidance for the field work by defining the sampling and data-gathering methods to be used. The types of samples to be collected are fish tissue, surface soil, surface water, and sediment. Duplicate samples, field blanks, and trip blanks will be utilized as methods of QA and are discussed in the QAPP. Laboratory QA samples, such as matrix spikes and matrix spike duplicates, are also discussed in the QAPP. Sampling methods, chain-of-custody, preservation and equipment procedures used to perform the work activities described in the Work Plan will comply with the US EPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001).

2.0 SAMPLE CONTROL, FIELD RECORDS, AND DOCUMENT CONTROL

This section presents procedures for sample control, field records, and document control. Sample control includes sample identification and chain-of-custody procedures. A sample is defined as physical evidence collected from a facility, site, or from the environment.

2.1 SAMPLE DESIGNATION

The method of sample identification used depends on the type of sample collected. Samples collected for specific field analyses or measurement data are recorded directly in bound logbooks (field books). Standard sample labels, which are attached to the sample containers, will be used to identify samples collected for laboratory analysis. Sample labels will be completed using waterproof, non-erasable ink. Each sample will be assigned a unique alphanumeric sample descriptor that identifies the sample type, sample area, sample site number, and sample interval, (if applicable). As an example, WEST BAY-SED-01 (4-5) would indicate the West Bay area, sediment sample #1 from a depth interval of four to five feet. The first group of letters specify the sample area location, the next set of letters specify the media type (e.g., SED for sediment, SW for surface water, SOIL for soil, and FISH for fish tissue), followed by the sample numbers presented sequentially from the first sample to the last, and other descriptive data where appropriate, such as the depth range across which the sample was collected. Anticipated sample areas are:

- WEST BAY: Beaver-impounded areas in the western portion of the site and Marrow Bone Creek;
- RIVER REEDY: Upstream reaches of the Reedy River;
- UPSTREAM: Upstream areas of the property north of Taylor's Island to the upper property boundary;
- EAST BAY: The easternmost inundated portion of the property;
- SOUTH BAY: The southernmost inundated portion of the property;
- CRESCENT SLOUGH: The crescent-shaped slough located in the south-central portion of the property; and
- TAYLORS ISLAND: The former lake island located in the north-central portion of the property that rises topographically above the area.

2.2 CHAIN-OF-CUSTODY PROCEDURES

Chain-of-custody procedures are established to maintain sample custody and documentation of samples for evidence. The possession of samples must be traceable from the time of collection to its introduction into evidence. Chain-of-custody procedures shall follow procedures as outlined in Section 3.0 of the QAPP.

The unique sample identification numbers discussed above will be included on the chain-of-custody form used to track the sample container. Duplicate samples will be given unique sample identification numbers and will be noted in the field book. This requirement does not apply to blind-spiked or blank samples, which are to be submitted for laboratory quality control purposes. Blind-spiked or blank samples shall not be identified as such.

Chain-of-custody forms must accompany all sample containers to document the transfer of the containers and samples from the originating laboratory, through the field collection, and to the laboratory receiving the samples for analyses. A sample container is under custody if:

1. It is in the field investigator's actual possession;
2. It is in the field investigator's view, after being in his/her physical possession; and/or
3. It was in the field investigator's physical possession and then she/he secured it to prevent tampering.

Each set of containers is shipped with a chain-of-custody form, which travels with the sample containers. A copy of the chain-of-custody form with its unique numbers of the samples that it tracks shall be kept in the laboratory to help identify lost or missing samples. If a sample chain-of-custody is lost in shipment, the field investigation will prepare a written statement detailing the pertinent information including the following:

- where and how the sample was collected,
- field book entries regarding the sample, and
- how and when the sample was shipped.

The role and responsibilities of the project/field personnel are delineated in the QAPP.

2.3 FIELD RECORDS

Documentation of an investigative team's field activities provides the basis for technical site evaluations and related written reports. Additionally, all records and notes generated in the field may be considered as evidence and may potentially be subject to scrutiny in litigation. It is essential that all field documentation provide a clear, unbiased picture of field activities. All aspects of sample collection and handling, as well as visual observations, shall be documented in the field books.

Bound field books will be used on work assignments requiring field activities. Entries into field books will be legibly written in indelible ink and provide a clear record of all field activities.

The following information must be provided on the inside front cover or first page of the field notes:

- Project Name and Project Manager
- Site Location
- Job Number
- Date

Instructions and procedures relating to the format and technique in which notebook entries are made are as follows:

1. Leave the first two pages blank. They will provide space for a table of contents to be added when the field notes are complete.
2. If photographs are taken as part of the field investigation, a photo description will be made in the notes at the time the photo is taken. Photo descriptions will be numbered sequentially in the notes.
3. Entries shall be made in waterproof ink.
4. Entries shall be made in language that is objective, factual, and free of personal feelings or other terminology, which might prove unclear or inappropriate.
5. Entries shall be printed as neatly as possible.
6. Entries will be logged according to military time.
7. Errors in the field notes will be indicated by drawing a single line through the text. Ensuring that the text is still legible. Initial and date all notations of errors.
8. A new page will be started at the beginning of each day's field activities and the remaining clear page at day's end will be marked out with a single initialed line at the day's end.
9. The person taking notes shall sign, number and date each page.
10. Later additions, clarifications, or corrections must be dated and signed.

Instructions and procedures providing guidance on the information to be recorded on field activities are provided below:

1. A new page should be used at the start of each day's activities. Identify the date, time, job number, location on-site personnel, and observed weather conditions. Changes in weather will be noted when they occur.
2. Include sketches or maps of the site, which can be used to identify photo and/or sample locations. Note landmarks, indicate north, and if possible, include an approximate scale. Include as many sketches and maps as needed.
3. Field personnel responsible for note taking shall log all photos taken in the field in the field book. The photo locations should be referenced to a site sketch or map. Photograph information will include the date, time, location, photographer, sample number, roll number, frame number, and a complete description or identification of the subject in the photograph.
4. Record on-site health and safety equipment used. Describe observed potential hazards to health and safety. Document the level of protection used, decontamination procedure used and specific decontamination solutions daily.
5. As part of the chain-of-custody procedure, sampling information must include sample number, date, time, sampling personnel, sample type, designation of sample as a grab or composite, and any preservative used. Sample locations should be referenced to sample numbers on a site sketch or map.
6. When sampling is complete, the field book entry shall include date, time, sample numbers, and description. Indicate whether or not the sample was a split or duplicate and who received the split or duplicate sample.
7. Information for *in situ* measurements will include a sample ID number, the date, time, and personnel taking measurements. If in-field calculations are necessary, they will be checked in the field and signed by a second team member, whenever possible.
8. If on-site interviews occur, record relevant information obtained. Include names of persons interviewed, the interest group represented (if applicable), address, and phone number.
9. Record any other relevant information, which would be difficult to acquire at a later date.

All project field books are the property of Zapata Engineering/The Pinnacle Consulting Group and will remain in their possession when the project has been concluded. None of the documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies.

2.4 PHOTOGRAPHS

As discussed in the previous section, photographs taken in the field will be documented in the field book. The locations of photographs should be referenced to a site map or sketch. Information in the field book must include the date, time, location, photographer, sample number (if appropriate), roll number, frame number, and a complete description or identification of the subject in the photograph.

After the film is developed, each slide or print should be labeled with, at a minimum, the following information:

- Job identification number
- Date
- Location
- Roll number
- Frame number
- Sample number (if appropriate)

3.0 SAMPLING DESIGN AND PROCEDURES

Samples are collected to obtain a representative portion of the material or medium being sampled. Valid results depend upon using proper sampling, sample handling, and preservation techniques; properly identifying the collected samples and documenting their collection in permanent field records; maintaining sample chain-of-custody; and protecting the collected samples by properly packing and transporting (shipping) them to a laboratory for analysis.

The following factors and procedures shall be considered and/or implemented in planning and conducting sampling operations. These factors and procedures must be considered in view of the specific objectives and scope of the field investigation as presented in the Work Plan and the QAPP.

- Safety of sampling personnel.
- Selection of representative sampling sites.
- Selection and proper preparation of sampling equipment.
- Selection of parameters to be measured and evaluation of sample fractions to be analyzed (e.g., dissolved, suspended or total fractions for water samples).
- Required sample volumes.
- Selection and proper preparation of sample containers.
- Sample preservation.
- Sample holding times.
- Sample handling and mixing.
- Sample identification.
- Transportation and shipping of samples.
- Sample chain-of-custody.

3.1 DEFINITIONS

Grab Sample-An individual sample collected from a single location at a specific time or period of time.

Composite Samples-A sample collected over a temporal or spatial range that typically consists of a series of discrete, equal samples, which are combined or "composited". The types of composite samples include:

Timed Composite-A sample containing a series of discrete samples taken at equal time intervals over the compositing period.

Flow Proportional Composite-A sample containing a series of discrete samples taken proportionally to the flow rate over the compositing period.

Areal Composite-A sample composited from individual grab samples collected over an areal or horizontal cross-section basis. The grab samples shall be of equal volume and shall be collected in an identical manner.

Split Samples-A sample that has been divided into two or more containers from a single sample container. Adequate mixing will be performed such that the two portions of a split sample are, for all practical purposes, identical. The primary purpose of a split sample is to measure sample handling variability.

Duplicate Samples-Two or more samples collected from a common source. The samples are collected simultaneously from the same source under identical conditions into separate containers.

Control or Background Samples-A sample taken in an area known or thought to be free from the COC.

Sample Aliquot-A portion of a sample that is representative of the entire sample.

Trip Blank-A sample which is prepared prior to the sampling event in the actual container and is stored with the investigative samples throughout the sampling event. The trip blank is used as a quality control check for organic compound analyses.

Field Blank-A sample that is prepared in the field to evaluate the potential for contamination of a sample by site contaminants from a source not associated with the sample collected. The sample containers are filled with organic-free deionized water in the field. The deionized water is handled in the same manner as the sample (e.g., if sample is groundwater that has been filtered, the deionized water will be filtered). Field blanks contain the same preservatives as the samples.

Rinsate Blank-A sample of organic-free deionized water that has been passed across the surface of sampling equipment after the equipment has been decontaminated. The rinsate blank is used to check for the effectiveness of the field decontamination procedure between samples.

3.2 DECONTAMINATION PROCEDURES

Decontamination procedures are intended for use by field personnel for cleaning sampling and other equipment in the field. Sampling and field equipment cleaned in accordance with these procedures will meet the minimum requirements for DQO data collection as specified in the QAPP.

Proper decontamination of sampling equipment is essential to prevent cross contamination of samples with the sampling device. All sampling equipment will be decontaminated before sampling and between each sample unless samples are to be composited. Sampling equipment will be decontaminated with materials and procedures specified in the QAPP and according to the following procedures:

- Clean with tap water and laboratory detergent using a brush if necessary to remove particulate matter and surface films.
- Rinse thoroughly with tap water.
- Rinse thoroughly with deionized water.
- Rinse once with propanol if organic compounds are the constituents of concern. Rinse once with 0.1N HCl if inorganic compounds are the constituents of concern. If both organic and inorganic compounds are of concern, the propanol rinse will take precedence.
- Rinse thoroughly with organic-free water and allow to air dry.
- Wrap with plastic to prevent contamination if equipment is going to be stored or transported.

Larger equipment such as drilling and/or backhoe equipment that may contact the samples will be steam cleaned (soap and high pressure hot water). During the field investigation, large equipment such as drill augers and bits will be steam cleaned. Sampling equipment such as split barrel samplers will be decontaminated according to the procedure describe above.

Tap water (potable) will be used for steam cleaning and will be obtained from the local public water supply. The public water supply will be sampled during the field investigation and analyzed for the organic compound fraction of the Target Compound List (TCL) list and for metals.

Spent decontamination fluids will be contained in steel 55 gallon drums and a random sample will be analyzed for VOCs, SVOCs, TAL metals, organo-chlorine pesticides, and PCBs. Disposal of the decontamination fluids will be based on the results of the analyses.

4.0 ENVIRONMENTAL SAMPLING

4.1 GENERAL CONSIDERATIONS AND SAMPLE LOCATIONS

Selection of a sampling location is based on many factors, including study objectives, water use, point source discharges, location and nature of tributaries, changes in stream characteristics, types of streambed, stream depth, turbulence, depositional environment, presence of structures (weirs, dams), and accessibility. Sampling sites on streams should be located in areas of the greatest cross sectional homogeneity. Since mixing is principally governed by turbulence and water velocity, the selection of a site immediately below a ripple area will ensure good vertical mixing. These locations are also likely areas for sediment deposition since the greatest deposition occurs where stream velocity decreases. Horizontal (cross channel) mixing occurs in constrictions in the channel, but because of velocity increases, the stream bottom may be scoured, and therefore, a constriction is a poor sediment sample location. Typical sediment deposition areas are located on the inside of river bends, downstream of islands, and downstream of obstructions in the water.

The selection of sampling station locations include, at a minimum, the following considerations:

- Time of water travel, not distance,
- Marked physical changes in the stream channel,
- Upstream and downstream relationships to target tributaries, discharges or investigation sites,
- Point-source waste discharge or tributary lateral mixing distance,
- Non-point source discharges, and
- Flow patterns at the months of tributaries and possible mixing with the main channel.

Seasonal variations will also be considered since water quality and sediment depositional areas may be strongly influenced by changing flow rates. This is also an important consideration when comparisons with other investigations are anticipated.

It is anticipated that the following samples will be collected:

- Lake Conestee Sediments - Shallow sediments will be collected from pool and slough areas in Lake Conestee that are generally inundated year-round. Sediments will be collected from the top two feet with the top six inches discarded. Samples will be collected from five lake areas:

- West Bay/Marrow Bone Creek – 15 samples
- Upstream Lake – 10 samples
- Crescent Slough – 1 sample
- East Bay – 17 samples
- South Bay – 7 samples

- Lake Conestee Surface Water - Surface water samples will be collected from the water column in the inundated areas of the lake. Samples will be collected from five lake areas:

  - West Bay/Marrow Bone Creek – 5 samples
  - Upstream Lake – 5 samples
  - Crescent Slough – 1 sample
  - East Bay – 3 samples
  - South Bay – 6 samples

- Fish Tissue - Ten fish will be collected from various habitats in Lake Conestee. The number of fish to be collected from each habitat is based on a distribution of the 10 allotted samples relative to the size of the habitat:

  - East Bay - 3 fish
  - South Bay - 2 fish
  - Reedy River - 3 fish
  - West Bay/Marrow Bone Creek – 2 fish

- Background Soil - Three surficial soil samples, collected from 6 to 12 inches in depth, will be taken from Taylor's Island from areas of the former island above historic inundation elevation.

- Reedy River Sediments - Sediment samples will be collected from three locations in the Reedy River upstream of the Lake Conestee. The top two feet of sediment, with the top six inches of sediment discarded, will be collected. The following samples will be collected:

  - Sample #1 to be collected from the headwaters reach of the Reedy River in the Travelers Rest, SC area. This reach is upstream of the City of Greenville and upstream of the impacts of the lagoons and contamination associated with former industrial activities at the Renfrew site and other industrial sites through the City. This location will provide reference data for sediment unimpacted by activities in/around the City of Greenville.

- Sample #2 to be collected upstream of the city of Greenville below the confluence with Langston Creek. This location will provide reference data for sediment unimpacted by activities in/around the City but downstream of human and industrial activities in the northern portion of the watershed.

- Sample #3 to be collected upstream of the WCRSA discharge into the Reedy River but downstream of the City of Greenville. This location will provide reference data for sediment impacted by activities in the City but unimpacted from WCRSA's discharge.

4.2 SURFACE WATER SAMPLING EQUIPMENT/TECHNIQUES-LAKE CONESTEE

For all sampling activities, the equipment or sampling techniques must not cause the integrity of the sample to be compromised and should provide a sample which is representative of the medium being sampled.

Samples from surface waters will be collected directly into sample containers (unpreserved bottleware) or decanted from a precleaned, location-dedicated container into the bottleware containing preservative. If accessible the sampler will stand along the edge of the lake or wade into the water, taking care to disturb bottom sediments as little as possible. Where inaccessible, a boat will be used to access the sample location.

4.3 SAMPLING EQUIPMENT/TECHNIQUES-DRY SEDIMENT/SOIL SAMPLES

Manual techniques and equipment used for subsurface soil sampling, such as hand augers, are usually used for surface or shallow, subsurface soil sampling. Power operated equipment is usually associated with collecting deep samples, but this equipment can also be used for collecting shallow samples when the auger hole begins to collapse, or when the soil is so tight that manual auguring is not practical.

Dry sediment/soil samples will be collected using a stainless steel hand auger. The samples will be collected from a depth range of surface to 12 inches with the top six inches of material discarded. The remaining sample aliquot will be placed into a stainless steel bowl for mixing, where appropriate. Soil samples for VOC analysis will be collected directly according to the procedures specified in SW-846 Method 5035 (US EPA, 1992).

4.4 SEDIMENT SAMPLING EQUIPMENT/TECHNIQUES-INUNDATED SAMPLES

Sediment samples collected from Lake Conestee will be comprised of samples from shallow inundated areas or samples from deeper inundated areas such as sloughs and beaver-impounded areas. For the shallow areas, either a stainless steel scoop or hand auger may be used to collect the sediment sample as described in Sections 4.3 and 4.5. For sample collection in deeper inundated areas, a stainless steel, sediment tube corer will be used. The sediment corer will be pushed through the water column and into the sediment. Sediment is then pushed directly into a 20-inch-long, two-inch-diameter, polyethylene sleeve that is fixed inside the stainless steel corer. Upon retrieval, a flap on the top of the device, which allowed surface water to escape during descent, prevents sample loss upon ascent. The top six inches of material will be discarded, and the remaining sample aliquot will be placed into a stainless steel bowl for mixing, where appropriate. Soil samples for VOC analysis will be collected directly according to the procedures specified in SW-846 Method 5035 (US EPA, 1992).

4.5 SEDIMENT SAMPLING EQUIPMENT/TECHNIQUES-RIVER SAMPLES

The Reedy River sediment samples will be collected using a stainless steel scoop/spoon or sediment corer as described in Section 4.4. In the scooping method, precautions will be taken to make the collected sample as representative of the sediment as possible.

The sampling devices will be decontaminated between each sample or clean equipment will be used for each sample. The samples will be collected upstream of the sample collector. Pebbles or cobbles greater than 5-mm diameter and vegetation will be removed from the sample prior to filling in the appropriate containers directly from the sampler. Subsamples will be composited in a decontaminated, stainless steel or bowl if a single scoop does not provide sufficient sediment volume to fill the required sample bottles.

4.6 FIELD ANALYTICAL TECHNIQUES-SURFACE WATER

Conductivity, temperature, and pH measurements will be collected for surface water samples. Instrument calibration will be conducted in accordance with manufacturer's specifications. Calibration information and dates will be recorded in the field book.

4.7 FISH TISSUE COLLECTION TECHNIQUES

Fish for tissue analysis will be collected with a backpack electroshocker by a licensed fisheries biologist experienced in conducting this type of sampling. Collected fish will be measured, weighed, identified to species level, contained in aluminum foil and labeled, sealable bags, and placed on wet ice immediately. The samples will be scaled and filleted after sample collection. Fillets will be contained in aluminum foil and labeled, sealed bags and placed on wet ice.

The electroshocker cannot be decontaminated according to standard practices due to the electrical components of the device. Gross decontamination will be conducted to remove mud or other debris from the probes. Equipment that will directly contact the tissue sample (e.g., measuring board, fillet knife, and scaler) will be decontaminated between each tissue preparation according to the procedures described in Section 3.2.

4.8 FIELD MAPPING AND SURVEYING

All sampling locations utilized during the field investigations will be surveyed and depicted on a scaled drawing, topographic or other standard map, or be referenced in such a manner that their location(s) are firmly established. Surveying will be conducted using GPS with an accuracy of +/- 10 feet. Taking accurate, complete, and informative field notes in surveying is a prime objective. The field notes are the only reliable record of measurements made and information gathered in the field. Survey information gathered will be recorded in the field on bound field notebooks. Notes will be permanent, legible, and complete and will be made with an indelible, waterproof ink pen.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

TABLE OF CONTENTS

1.0 INTRODUCTION

This Addendum to the Quality Assurance Project Plan (QAPP) has been prepared for the activities associated with the Targeted Brownfields Assessment follow up investigation at Lake Conestee. The QAPP presents the details of the policies, organization, objectives, QA activities, and QC activities that are intended to achieve the DQOs of the investigation. This Addendum to the QAPP is to be used in conjunction with the addenda to the FSAP and Work Plan prepared for the Lake Conestee follow-up investigation.

The activities conducted in association with the Lake Conestee Follow-up Investigation will be consistent with Test Methods for Evaluating Solid Waste – Physical/Chemical Methods (SW-846; US EPA, 1992). This QAPP has been developed according to the following guidance documents:

- EPA Guidance for Preparing Quality Assurance Project Plans (US EPA, 1998),
- EPA Guidance for the Data Quality Objectives Process (US EPA, 2000),
- EPA Requirements for Quality Assurance Project Plans (US EPA, 2001), and
- Region IV Environmental Investigations-Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001).

2.0 PROJECT MANAGEMENT

The major roles and personnel assigned for the Lake Conestee follow-up investigation are shown in Figure 1.

2.1 DISTRIBUTION LIST

This Addendum to the QAPP will be distributed along with the addenda to the Work Plan and FSAP.

2.2 PROJECT ORGANIZATION AND ROLES

The investigation will be managed according to the line of authority described in this section. The project position and associated responsibilities are described in the following paragraphs.

The work elements of the follow-up investigation will be implemented and supervised by experienced earth sciences and engineering professionals.

David L. Hargett, Ph. D., CGWP, CPSS will serve as the overall project coordinator, Senior Consultant, and liaison with the site owner, The Conestee Foundation. In these roles, he will be a primary communication contact for all parties. In addition, he will be involved in technical aspects of the effort to ensure that the overall goals of the effort are attained. Dr. Hargett has spent hundreds of hours on Lake Conestee and has unequaled knowledge of the site. Dr. Hargett will be a primary QA/QC reviewer.

Greg Hippert will serve as the Zapata Engineering and overall project manager. In this role, he will coordinate the work elements that both Zapata and Pinnacle will implement, assist Pinnacle with the work elements for which Pinnacle will have primary responsibility, assist in and supervise the field efforts, assist with data review and evaluation, and will prepare relevant sections of the final report. Mr. Hippert will provide support for the Site Health and Safety Officer. He will be responsible for overall administrative program management, communication with the USACE, and resource allocation for Zapata.

Jerry A. Wylie, P.G. will serve as the Pinnacle Consulting Group project manager and certifying South Carolina Professional Geologist of record for the project. In this role, he will coordinate the work elements that Pinnacle will implement, assist Zapata Engineering with the work elements for which Zapata will have primary responsibility, assist in the field efforts, assist with data review and evaluation, and will coordinate submittals to the appropriate parties. Mr. Wylie will both participate in and supervise the data gathering efforts and will be on site for a representative portion of the field activities. He will be the primary writer of the final report. Mr. Wylie will be responsible for overall administrative project management and resource allocation for Pinnacle.

Bradley Kuntz will serve as the Zapata/Pinnacle field operations manager and site health and safety officer. Mr. Kuntz will be responsible for the planning and implementation of the field effort and assuring compliance of all site workers/visitors with the SSHP.

2.3 PROBLEM DEFINITION

The objectives of this phase of the TBA are to assess releases of hazardous substances onto the property that could impact its use as a community greenspace and environmental education facility. The results of this phase of investigation will also assist in determining the need for cleanup or control measures to protect human health and the environment. Assessment activities include data gathering and analysis to evaluate the nature and general extent of residual contaminants-of-concern. The data must be of sufficient quality and quantity to support subsequent site-related activities (e.g., use as a greenspace, remedial actions, etc.).

2.4 GENERAL PROJECT DESCRIPTION AND SCHEDULE

An follow-up investigation of the nature and general extent of residual chemical impact to the soils, sediments, and surface waters of Lake Conestee will be conducted. Direct sampling and chemical analysis of environmental media will be used to develop assessment data. Based on the data derived from this assessment, decisions can be made concerning the site's usability and/or the need for further investigation or remediation.

The schedule for implementation of the follow-up investigation is included as Figure 2. The schedule is a timeline of activities and milestone events associated with implementation of the investigation.

2.5 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

The Work Plan and a FSAP were prepared separately. Section 4.0 of the Work Plan discusses the development of DQOs according to the US EPA's recent guidance (US EPA, 2000). The DQO development process involves the following steps:

1. State the Problem

2. Identify the Decision
3. Identify Inputs to the Decision
4. Define the Study Boundaries
5. Develop a Decision Rule
6. Specify Limits on Decision Errors
7. Optimize the Design for Obtaining Data

2.6 DOCUMENTATION AND RECORDS

In summary, data will be collected in the field or in the laboratory and will be transferred to an appropriate summary form. The appropriate team member as designated by the Project Manager will validate (i.e., check the completeness and accuracy) all data generated. The validated data will be compiled and reported according to the project schedule.

2.6.1 Field Data

Field data will be recorded on data collection sheets or directly in a field log book. Data to be recorded includes visual observations, chemical analysis (e.g., pH, conductivity, temperature, etc), and physical measurements (e.g., sample depth, sample location etc). Field personnel will evaluate this information at the time of collection for accuracy based on instrument response, calibration results, and related measurements where applicable. Data that appears to be an outlier will be confirmed by a second measurement or by recalibration of the instrument where possible. In the event of an instrument malfunction, a replacement instrument will be utilized where possible. Any questionable results identified by the sampling personnel will be noted as such and evaluated further by the QA/QC team. An additional review of the field data will be performed by the Project Manager after the data have been finalized and submitted by the field personnel. This validation review will include confirmation of appropriate frequency and procedures for calibration, completeness of the data, and appropriate documentation of the measurements. Any datum that is identified as not meeting the QC criteria will flagged appropriately based on the severity of the deviation from the criteria. If necessary, the datum will be declared invalid and will not be used for any subsequent calculations or decision-making processes. If invalidated data are considered critical, the Project Manager may require re-measurement.

Analytical results for field measurements will be available immediately. Records associated with the field measurements (e.g., field log books, field data collection sheets, etc) will be retained for a minimum of 10 years.

2.6.2 Laboratory Data

Laboratory data will be recorded according to the analytical laboratory's standard procedures. The laboratory's QA/QC program addresses the procedures for evaluating the validity of the data being generated, and the response to be taken in the event the QC criteria are not met. A copy of the laboratory's quality systems manual is attached to this QAPP as Attachment 1. The laboratory will assign flags to data that do not meet all QA parameters to indicate possible reduction in data quality. These flags along with an explanation of their meaning will appear with the data in any summary tables or other reports that include the data. An additional review of the laboratory data will be performed after the data have been received. This validation review will include an assessment of data quality indicators to determine the data usability. The five common data quality indicators that will be evaluated are precision, accuracy, representativeness, completeness, and comparability. The indicators are commonly referred to as the PARCC parameters. These indicators are assessed through field and laboratory QC samples and other procedures. Each is discussed in the following paragraphs.

Precision measures the reproducibility of measurements under a given set of conditions. Specifically, it is the quantitative measure of the variability of a group of measurements compared to the average value. The overall precision of measurement data is a mixture of sampling and analytical factors. Analytical precision is much easier to control and quantify than sampling precision. Sampling precision may be determined by collecting and analyzing replicate field samples. The analytical results from laboratory replicates provide data on analytical precision. Subtracting the analytical precision from the measurement precision defines the sampling precision.

Accuracy measures the bias in a measurement system. Accuracy is difficult to measure for the entire data collection activity. Sources of error are the sampling process, cross contamination, preservation, sample handling, sample matrix, sample preparation, and analysis techniques. Analytical accuracy is assessed through use of known and unknown QC samples and spike samples. Accuracy determinations by known samples include single control and duplicate control samples, commonly referred to as laboratory control samples. These are samples made up of reagent grade water that is spiked with known amounts of target compounds. Percent recovery and percent difference parameters are determined from these samples. Analytical accuracy determinations by unknown samples include the evaluation of matrix interferences in the environmental samples. These samples also provide percent recovery and percent difference parameters through the use of surrogate and matrix spikes in the environmental samples.

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Making certain that sampling locations are selected properly and a sufficient number of samples are collected best satisfies the representativeness criterion.

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is essentially the same for all data uses: that a sufficient amount of valid data be generated. It is important that critical samples are collected and valid data achieved for them.

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data should be comparable with other measurement data for similar samples and sample conditions. This goal is achieved through using standard techniques to collect and analyze representative samples and reporting analytical results in appropriate units. Comparability is limited to the other PARCC parameters because comparisons between data sets require known precision and accuracy.

The laboratory data will be evaluated using the PARCC parameters to the extent possible based on available information. Any datum identified as not meeting the QC criteria will be flagged appropriately based on the severity of the deviation from the criteria. If necessary, the datum will declared invalid and will not be used for any subsequent calculations or decision making processes. If invalidated data are considered critical, the Project Manager may require re-analysis if there is sufficient sample remaining within the required holding time or recollection and analysis.

Analytical results for the laboratory analysis are expected to be available within 21 days of sample collection. Complete Level III data packages are expected to be received within 14 days after receiving the analytical results. The analytical reports and data packages will be retained for a minimum of 10 years.

3.0 MEASUREMENT AND DATA ACQUISITION

This section presents information related to measurement and data acquisition that is not contained in other related documents. Where the required information is contained in another document, the appropriate reference is provided.

3.1 SAMPLING PROCESS DESIGN

The sampling process design is provided in Section 2.1 of the FSAP.

3.2 SAMPLING METHOD REQUIREMENTS

Sample quality will be ensured through the use of appropriate sampling techniques, containers, and handling procedures. The FSAP was prepared according to the US EPA Region IV Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (US EPA, 2001). Descriptions of sampling methods for each media to be sampled are included in the following sections of the FSAP:

- Surface Water — Section 4.2
- Sediment — Section 4.3, 4.4, and 4.5
- Fish Tissue — Section 4.7
- Soil — Section 4.3

Samples will be collected from locations that are intended to provide information about background and on-site levels of analytes. The sample locations chosen and the numbers of samples from each medium are presented in the FSAP.

Table 1 presents the sample containers, preservatives, and holding times for each group of analytes. Precleaned sample containers will be obtained from the analytical laboratory along with the appropriate preservatives. Sample containers will be secured from the time of receipt from the laboratory, through collection, and until the time of delivery to the laboratory or courier.

Sample custody is presented in Section 3.3 of this QAPP. Procedures for sample and photographic documentation are discussed in Section 2.4 of the FSAP. The discussion includes information concerning sample identification, chain-of-custody, and field records.

3.3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

Appropriate sample handling and custody helps to ensure the quality and accuracy of the analytical results. Sampling personnel will be responsible for recording the appropriate information on the sample containers, in field logbooks, and on the corresponding chain-of-custody forms. The following subsections of this QAPP describe the sample handling and custody procedures.

3.3.1 Sample Handling

The appropriate sample containers and preservatives will be assembled for the sample to be collected. Prior to sampling, a self-adhesive label will be affixed to each sample bottle. The label will be completed using waterproof ink immediately prior to sample collection and will contain the following information:

- Client – Job Name/Project Number,
- Sample identification,
- Date and time collected,
- Sampler's signature or initials
- Preservatives added, and
- Analysis to be performed.

The following information will also be recorded in a bound field log book:

- sample identification,
- date and time of collection,
- personnel present,
- type of sample,
- analysis required,
- sample location and depth (if applicable),
- containers filled, and
- preservatives used.

3.3.2 Sample Custody

Chain-of-custody forms will accompany samples containers to document the transfer of possession of the originating laboratory, through field collection, and to the laboratory receiving the samples for analysis. A sample container is considered to be in the possession of field personnel when:

- it is in the persons actual possession;
- it is in the persons view, after being in their possession; or,
- it was secured by the person in such a way as to prevent unauthorized access.

Each time possession of samples change, the appropriate section of the chain-of-custody form will be completed. The person relinquishing custody will sign and record the date and time custody was relinquished. The person receiving custody will also sign and record the date and time custody was received.

Sampling personnel will complete and verify the chain-of-custody forms. A copy of the chain-of-custody form will be retained and placed in the project file. The original form will accompany the samples to the laboratory. Prior to shipping, the shipping container will be secured with the competed chain-of-custody form inside. The shipping container will be closed and secured with appropriate shipping tape. A custody seal will be affixed across the opening of the container. The seal will be labeled with the date and signature of the sampler.

When received by the laboratory, the samples will be managed according the laboratory's QA procedures (Attachment 1). Typically, the receiving laboratory will perform the following:

- Inspect the shipping containers and note the physical condition and confirm that custody seals are intact.
- Inspect each sample container for damage or leaks and inspect the label.
- Note the presence or absence of sample container custody seals.
- Reconcile the samples received against the chain-of-custody record including the sample identification, type of sample, volume, preservative, date collected, time collected, and analysis required.
- Log the samples in the laboratory logbook, prepare a sample receipt report, assign a laboratory identification number, and store the sample in a secure sample storage area.
- Notify the sampler of any problems with the samples received (e.g., broken bottles, missing seals, conflicts between chain of custody information and sample label information).

Conflicts between the sample label and the chain of custody will be resolved before the sample is assigned for analysis. The sampler will be informed of any such discrepancies and their resolution. The conflict and its resolution will also be documented in the laboratory report.

3.4 ANALYTICAL METHODS REQUIREMENTS

There are five analytical levels recognized by the Superfund Program (US EPA, 1987). Table 2 presents a summary of these levels. These levels are useful in describing the level of analysis that will be performed. For the Lake Conestee follow-up investigation, Levels I and III data will be prepared.

Samples collected during the investigation will be analyzed for the parameters described for each media in the Work Plan and FSAP. Laboratory procedures consistent with the DQO Level III, such as methods described in Test Methods for Evaluating Solid Waste-Physical/Chemical Methods, SW-846, 3rd Edition (SW-846 US EPA, 1992), will be principally used. The proposed SW-846 analytical methods are included in Table 1.

3.5 QUALITY CONTROL REQUIREMENTS

Quality control activities will be performed by collecting QC samples and by various laboratory QC activities. Samples that will be used for QC purposes include trip blanks, field blanks, duplicate samples, split samples, and matrix spike samples. Each of these sample types is discussed in the following paragraphs. The Accutest Laboratories Southeast, Inc. laboratory will analyze samples collected for off-site analysis during the Lake Conestee follow-up investigation.

A trip blank is a sample that travels with the sample containers from the laboratory, and remains with the samples during sample collection and shipment back to the laboratory. The trip blank is prepared by filling a sample container with organic-free water and any required preservative. Trip blanks are routinely used for volatile organics analyses. Trip blanks will be used at a rate of one per shipping container per sample matrix.

A field blank is collected at the same time other samples are being collected. A sample container is filled with organic-free water and the appropriate preservative. The water used to fill the container has been handled the same as the other samples; that is, it is poured over or through any sampling equipment that is used to collect samples after decontamination. Field blanks measure the effectiveness of decontamination procedures and measure the quantity of analytes introduced through the sampling procedures. Field blanks are used for both organic and inorganic analysis. Field blanks will be collected at a rate of one per sampling round per matrix.

Field duplicate samples are used to measure the precision of the sampling and analysis. The sample is collected by dividing a thoroughly mixed sample (except in the case of volatile organic analysis) into two parts. The two parts are then submitted as separate samples to the laboratory for analysis. The relative percent difference between the two sample results can be calculated. Field duplicates will be collected at a rate of 1 per 20 samples per matrix.

Split samples are similar to duplicate samples. The sample is collected in the same manner, but the analysis is performed by two separate laboratories. The split sample provides a measure of accuracy in the sample analysis. Split samples will be collected at the request of the regulatory agencies.

Matrix spike samples are used to quantify the effect of the sample matrix on the analysis methodology. The sample is collected similar to the duplicate sample, but a known amount of analyte is added to the sample by the laboratory.

During the data validation process described in Section 2.6, the results of the QC samples will be used to evaluate the PARCC parameters. Appropriate actions will be taken during the validation process according to the methods contained in SW-846 (US EPA, 1992).

3.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Instruments and equipment used in the field during the investigation will be frequently tested and inspected to confirm proper operation. Spare parts will be maintained to prevent delays in equipment repair. Backup instruments will be accessible should primary equipment fail. The off-site laboratory will be responsible for testing, inspecting, and maintaining their equipment.

Field equipment will be maintained and calibrated according to the frequency and procedures contained in the manufacturer's requirements. Field calibration and maintenance will be documented in the field logbook.

3.7 INSTRUMENT CALIBRATION AND FREQUENCY

Instrument calibration is an important part of an effective QA program. All instruments related to data collection that are capable of adjustment will be properly calibrated at the appropriate frequency. Calibration records will also be maintained as evidence of properly operating instruments. Laboratory equipment will be calibrated according to the laboratory's QA plan (Attachment 1). Field equipment will be calibrated according to the following schedule:

- pH meter daily (start, end)
- Conductivity Meter daily_(start, end)
- Thermometer semi-annually

3.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

The Project Manager is responsible for inspecting the supplies and consumables to be used on this project. The supplies and consumables include the following:

- Sampling equipment – sample containers, shipping containers, and organic-free water.
- Decontamination fluids – detergent, potable water, deionized water, isopropyl alcohol.
- Personal protective equipment – gloves and coveralls.

Shipping containers received from the laboratory will be inspected and inventoried to confirm that all requested items have been received and are in good condition. The shipping container will be inspected for signs of tampering or mishandling. Replacements will be requested from the laboratory as necessary.

Detergent for decontamination will be purchased for the project. When received, it will be inspected to confirm it is appropriate for the intended use. The potable water supply will be confirmed to be secure and easily accessible. Deionized water and laboratory pure water will be obtained from the analytical laboratory. The laboratory will supply the water in sealed containers with documentation of the quality of the water (i.e., deionized or organic-free). The water will not be used unless it is received with the seals intact and the appropriate documentation.

The pesticide-free isopropanol for decontamination will be purchased for the project. The containers will be inspected for damage and for intact seals. It the containers are damaged or the seals not intact, the isopropanol will be rejected.

New personal protective equipment will be used for the project. Each item will be visually inspected prior to use to ensure that it is undamaged and not contaminated. If any equipment is damaged or contaminated, it will be rejected.

4.0 ASSESSMENT AND OVERSIGHT

4.1 ASSESSMENT AND RESPONSE ACTIONS

Assessments will be performed throughout the project to ensure the quality of the data collected and the reports generated. Corrective action will be taken to prevent recurrence of any non-conformances.

The off-site laboratory will be responsible for performing internal audits and assessments to ensure their data quality. Any deficiencies identified by the assessments will be addressed by the laboratory's corrective action program (Attachment 1).

Field personnel are responsible for assessing the operation of the equipment they are using through calibration and observation of performance. Corrective actions will be instituted whenever conditions are identified that may negatively affect the quality of the information being acquired. All staff members are responsible for reporting any project activity or product discovered in nonconformance with established plans and procedures and to initiate the corrective action process.

The procedure for reporting nonconformance includes the following three steps:

- The discoverer of the nonconformance will immediately notify the on-site coordinator who will in turn notify the task leader and the QA officer.
- The task leader will then investigate the extent of the problem and recommend corrective action.
- Any data that has been adversely affected by the nonconformance will be identified and documented in the project file. If necessary, the data will be rejected.

System audits will be performed throughout the project. The on-site coordinator or the remedial investigation task leader is responsible for supervising and checking that each batch of samples is collected. The samples should be handled in accordance with the approved methods describe in the project documents.

Audits will be performed on the following activities:

- Field Performance audits – At least one day per week, the Project Manager will personally observe field personnel collecting samples, packing samples for shipment, decontaminating equipment, etc. The Project Manager will personally oversee subcontractors.

- System audits – The Project Manager will personally review all project documentation at least weekly. Before a report or technical memo is issued, the Project Manager, QA officer, or an assigned qualified QA reviewer will review the item.
- QA Program audits - The project coordinator will regularly review the QA program with the QA Officer to ensure that the quality assurance program is being implemented.

Corrective actions will be taken based on deficiencies identified during an audit or at any other time. The specific corrective actions will differ based on the nature of the deficiency. However, the general corrective action program will be implemented as follows. The recommended corrective action will be documented in a memorandum along with the time for implementation. The QA Officer will follow up to ensure that the recommended corrective action has been implemented. The results of the follow-up assessment will be documented in a memorandum.

4.2 REPORTS TO MANAGEMENT

The Project Manager will review field notes, sampling records, and chain-of-custody forms and will provide a summary of any significant QA problems and recommended solutions.

Laboratory data will be checked before release according to the laboratory's QA/QC program (Attachment 1). Once the data are received from the laboratory, a member of the project team will also review the data. Information concerning the quality of the data will be included in the Assessment Report. The Assessment Report will include:

- A copy of the laboratory report.
- A summary of the data quality.
- An assessment of the PARCC parameters.
- A discussion of any quality control problems and corrective actions undertaken to resolve problems.

5.0 DATA VALIDATION AND USABILITY

5.1 DATA REVIEW, VALDATION, AND VERIFICATION REQUIREMENTS

Field and laboratory data will be reviewed by a QC Reviewer to evaluate the PARCC parameters. The criteria for accepting or rejecting data are those described in Section 3.5 of this QAPP. The general review process is listed in Section 2.6 of this QAPP.

5.2 VALIDATION AND VERIFICATION METHODS

The validation process will be conducted according to the appropriate sections of SW-846. The review will be appropriately documented. The general review process is listed in Section 2.6 of this QAPP. Data associated with QC parameters that are outside of acceptable limits will be flagged as such and an explanation of the deviation will be included in the report. The QA Officer is responsible for ensuring that any corrective actions required by field personnel or the laboratory are implemented.

5.3 RECONCILIATION WITH USER REQUIREMENTS

The project QA/QC Reviewer will assign the appropriate data qualifiers to any analysis results that may not meet the PARCC parameters. Any data that are rejected based on the PARCC review will be discussed with the Zapata/Pinnacle Project Manager who will decide whether re-sampling or analysis is required in order to meet the DQO of the project. The Assessment Report will include information concerning the data quality.

TABLE 1

Sampling and Analytical Requirements

Lake Conestee Brownfields

				LABORATORY QA SAMPLES						
TYPE OF SAMPLE	PARAMETER	Analytical Methods	NO. of Field Samples	NO. of Dups/ Splits	NO. of Smplr Rnsts	NO. of Trip Blanks[1]	Total Samples	Holding Times	Preservation	Sample Cntnrs
FISH TISSUE	PCBs	EPA 8082	10	1	0	0	11		Cool to 4°C	
	Organo-chlorine Pesticides	EPA 8081A	10	1	0	0	11		Cool to 4°C	
	TAL Metals	EPA 6010B/7000A	10	1	0	0	11		Cool to 4°C	
IDW WATER	VOCs	EPA 8260B	1	0	0	0	1	14 Days	Cool to 4°C; HCL or H_2SO_4 to pH<2[2]	3 - 40 mL GSV[3]
	TAL Metals	EPA 6010B/7000A	1	0	0	0	1	6 Months except Hg; 28 Days for Hg	Cool to 4°C; HNO_3 to pH<2	1 L HDPE
	PCBs	EPA 8082	1	0	0	0	1	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	Organo-chlorine Pesticides	EPA 8081A	1	0	0	0	1	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	SVOCs	EPA 8270C	1	0	0	0	1	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
"UNSAMPLED AREAS" SEDIMENT SAMPLES	TAL Metals	EPA 6010B/7000A	25	2	2	0	29	6 Months except Hg; 28 Days for Hg	Cool to 4°C	250 mL CWM
	VOCs	EPA 8260B	5	1	1	1	8		Cool to 4°C	
	PAHs	EPA 8270C	20	2	2	0	24	14d/40d[4]	Cool to 4°C	250 mL CWM
	PCBs	EPA 8082	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	Organo-chlorine Pesticides	EPA 8081A	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	SVOCs	EPA 8270C	5	1	1	0	7	14d/40d[4]	Cool to 4°C	250 mL CWM

TABLE 1

Sampling and Analytical Requirements

Lake Conestee Brownfields

				LABORATORY QA SAMPLES						
TYPE OF SAMPLE	PARAMETER	Analytical Methods	NO. of Field Samples	NO. of Dups/ Splits	NO. of Smplr Rnsts	NO. of Trip Blanks[1]	Total A-E Smpls	Holding Times	Preservation	Sample Cntnrs
"NEW EXPOSURE AREAS" SURFACE WATER SAMPLES	TAL Metals	EPA 6010B/7000A	10	1	1	0	12	6 Months except Hg; 28 Days for Hg	Cool to 4°C; HNO3 to pH<2	1 L HDPE
	PAHs	EPA 8270C	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	Organo-chlorine Pesticides	EPA 8081A	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	PCBs	EPA 8082	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
"NEW EXPOSURE AREAS" SEDIMENT SAMPLES	TAL Metals	EPA 6010B/7000A	25	2	2	0	29	6 Months except Hg; 28 Days for Hg	Cool to 4°C	250 mL CWM
	PAHs	EPA 8270C	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	Organo-chlorine Pesticides	EPA 8081A	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM
	PCBs	EPA 8082	25	2	2	0	29	14d/40d[4]	Cool to 4°C	250 mL CWM

TABLE 1

Sampling and Analytical Requirements

Lake Conestee Brownfields

				LABORATORY QA SAMPLES						
TYPE OF SAMPLE	PARAMETER	Analytical Methods	NO. of Field Samples	NO. of Dups/ Splits	NO. of Smplr Rnsts	NO. of Trip Blanks[1]	Total A-E Smpls	Holding Times	Preservation	Sample Cntnrs
"BACKGROUND" SOIL AND SEDIMENT SAMPLES	TAL Metals	EPA 6010B/7000A	6	1	1	0	8	6 Months except Hg; 28 Days for Hg	Cool to 4°C	250 mL CWM
"UNSAMPLED AREAS" SURFACE WATER SAMPLES	TAL Metals	EPA 6010B/7000A	10	1	1	0	12	6 Months except Hg; 28 Days for Hg	Cool to 4°C; HNO_3 to pH<2	1 L HDPE
	VOCS	EPA 8260B	2	1	1	1	5	14 Days	Cool to 4°C; HCL or H_2SO_4 to pH<2[2]	3 - 40 mL GSV[3]
	PAHs	EPA 8270C	8	1	1	0	10	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	Organo-chlorine Pesticides	EPA 8081A	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	PCBs	EPA 8082	10	1	1	0	12	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG
	SVOCs	EPA 8270C	2	1	1	0	4	7d/40d[5]	Cool to 4°C[2]	2 - 1 L AG

[1] Estimated quantity. One trip blank per cooler containing VOC samples.
[2] Add 0.008% $Na_2S_2O_3$ if residual Cl present
[3] No headspace.
[4] 14 days until extraction/analyzed within 40 days after extraction
[5] 7 days until extraction/analyzed within 40 days after extraction.

HDPE = high density polyethylene bottle
AG = Amber Glass bottle with Teflon-lined cap
GSV = glass VOA vial with Teflon septa cap
CWM = clear wide-mouthed glass jar with Teflon-lined cap

Table 2
Analytical Levels for Superfund RI/FS

Analytical Level	Type of Analysis	Examples
Level I	Field Screening	Organic vapor analyzer Methane monitor pH meter Dissolved oxygen meter Explosive gas meter
Level II	Field Analytical	Portable or mobile instruments Field gas chromatograph Chemical or biochemical test kits
Level III	Non CLP Laboratory Analysis	SW-846 Methodology Standard Methods for Wastewater Analysis Air Sampling and Analysis
Level IV	CLP Laboratory Analysis	Follows CLP methodology
Level V	Non-conventional testing	Modifications of existing methods Experimental methodology

Figure 1
Zapata/Pinnacle Project Team
Follow-Up Investigation Activities
Lake Conestee, Greenville County, South Carolina

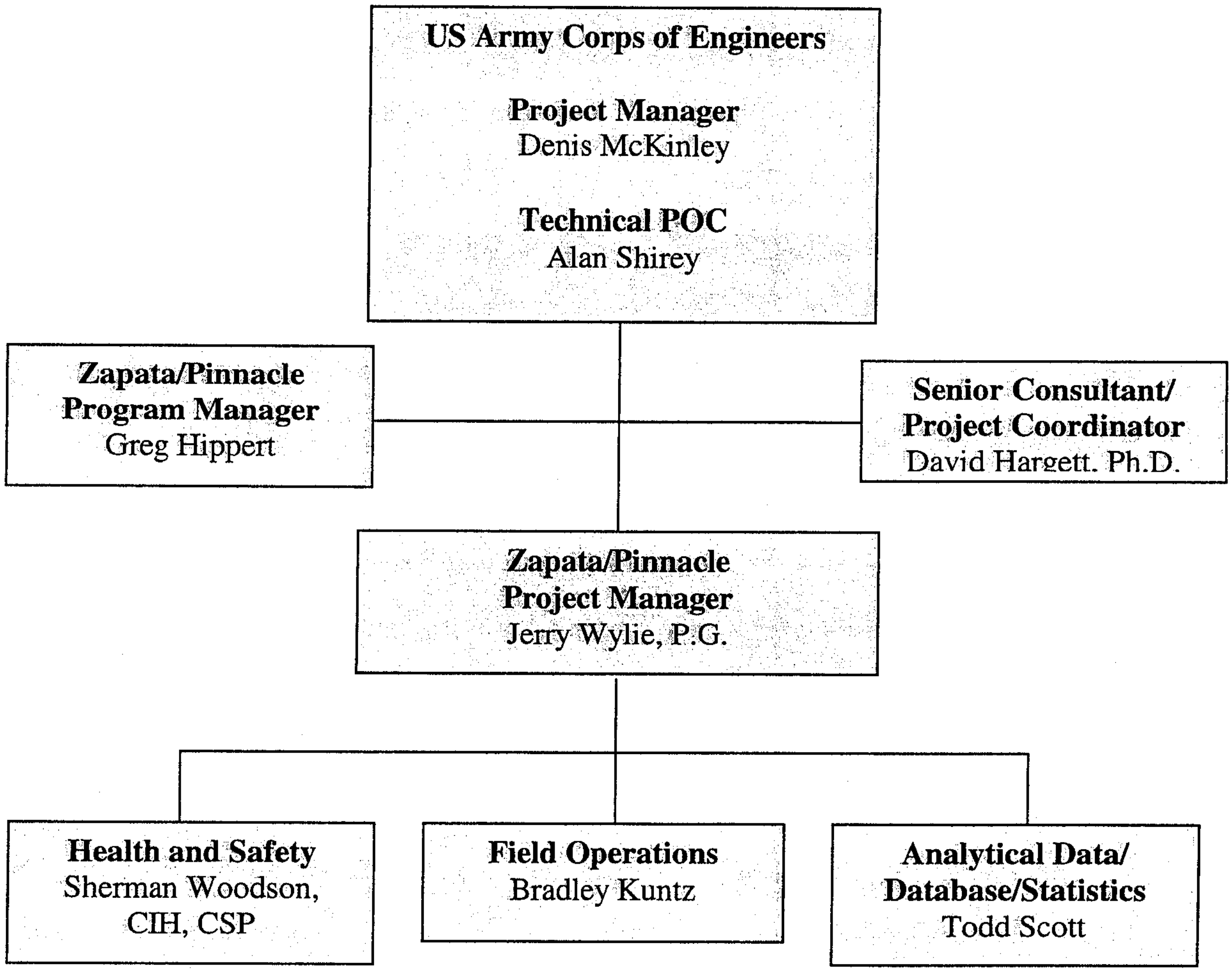
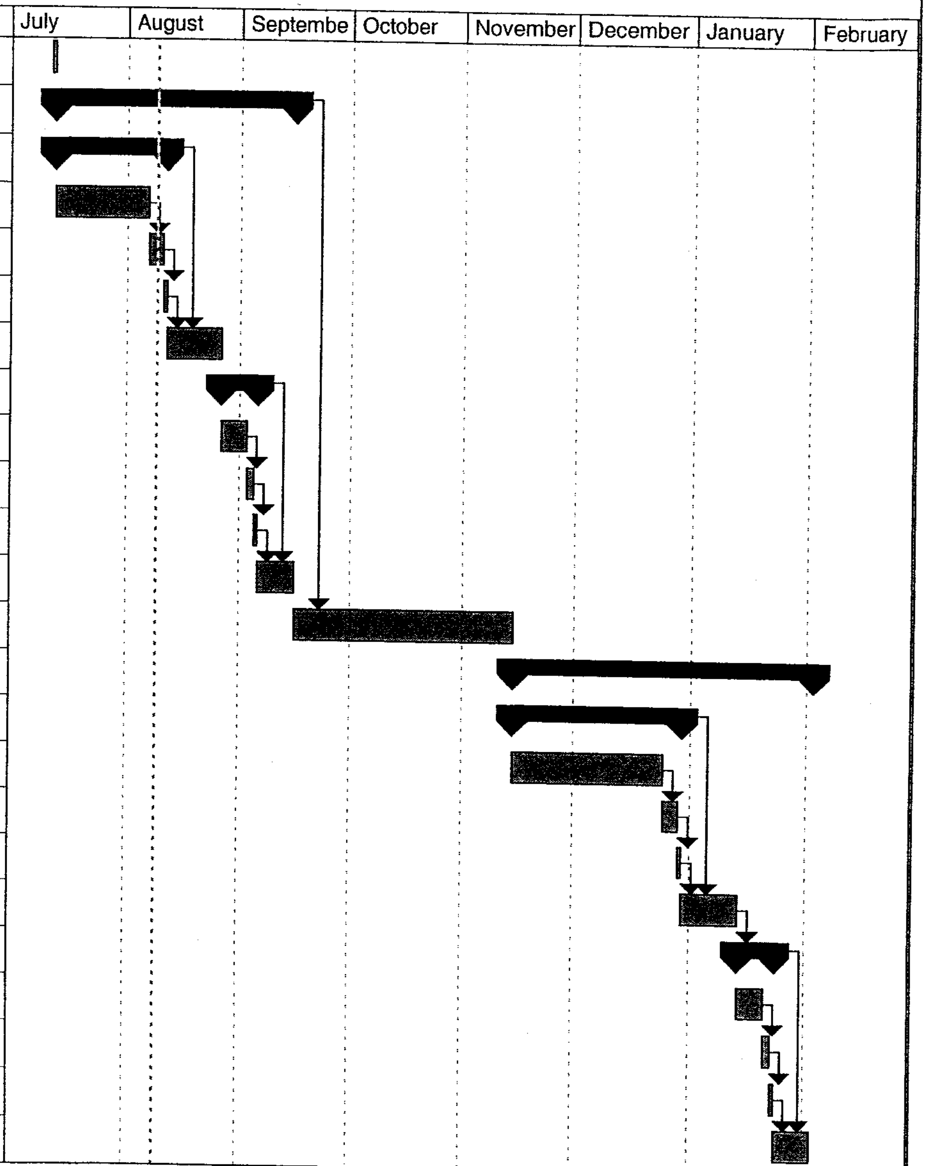
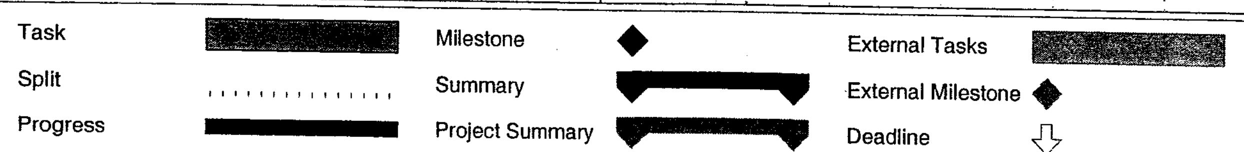


Figure 2
Targeted Brownfields Assessment Follow-Up Investigation
Lake Conestee, Greenville, South Carolina

ID	Task Name	Duration	Start	Finish
1	**Notice to Proceed**	**1 day**	**Fri 7/12/02**	**Fri 7/12/02**
2	**Workplan Addendum**	**65 days**	**Sat 7/13/02**	**Sun 9/15/02**
3	**Draft Workplan Addendum**	**30 days**	**Sat 7/13/02**	**Sun 8/11/02**
4	Develop Draft Workplan Addendum	25 days	Sat 7/13/02	Tue 8/6/02
5	Internal Review & Packaging	4 days	Wed 8/7/02	Sat 8/10/02
6	Submit Draft Workplan Addendum	1 day	Sun 8/11/02	Sun 8/11/02
7	Approve Draft Workplan Addendum	15 days	Mon 8/12/02	Mon 8/26/02
8	**Final Workplan Addendum**	**10 days**	**Tue 8/27/02**	**Thu 9/5/02**
9	Develop Final Workplan Addendum	7 days	Tue 8/27/02	Mon 9/2/02
10	Internal Review & Packaging	2 days	Tue 9/3/02	Wed 9/4/02
11	Submit Final Workplan Addendum	1 day	Thu 9/5/02	Thu 9/5/02
12	Approve Final Workplan Addendum	10 days	Fri 9/6/02	Sun 9/15/02
13	**Complete Site Assessment**	**60 days**	**Mon 9/16/02**	**Thu 11/14/02**
14	**Site Assessment Report**	**80 days**	**Fri 11/15/02**	**Sun 2/2/03**
15	**Draft Assessment Report**	**45 days**	**Fri 11/15/02**	**Sun 12/29/02**
16	Develop Draft Assessment Report	40 days	Fri 11/15/02	Tue 12/24/02
17	Internal Review & Packaging	4 days	Wed 12/25/02	Sat 12/28/02
18	Submit Draft Assessment Report	1 day	Sun 12/29/02	Sun 12/29/02
19	Approve Draft Assessment Report	15 days	Mon 12/30/02	Mon 1/13/03
20	**Final Assessment Report**	**10 days**	**Tue 1/14/03**	**Thu 1/23/03**
21	Develop Final Assessment Report	7 days	Tue 1/14/03	Mon 1/20/03
22	Internal Review	2 days	Tue 1/21/03	Wed 1/22/03
23	Submit Final Assessment Report	1 day	Thu 1/23/03	Thu 1/23/03
24	Approve Final Assessment Report	10 days	Fri 1/24/03	Sun 2/2/03



Date: 6/25/02
DACA21-02-D-0006-0001



ATTACHMENT 1

ACCUTEST SOUTHEAST

QUALITY SYSTEMS MANUAL